MAY 1953

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

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POWDER METALLURGY
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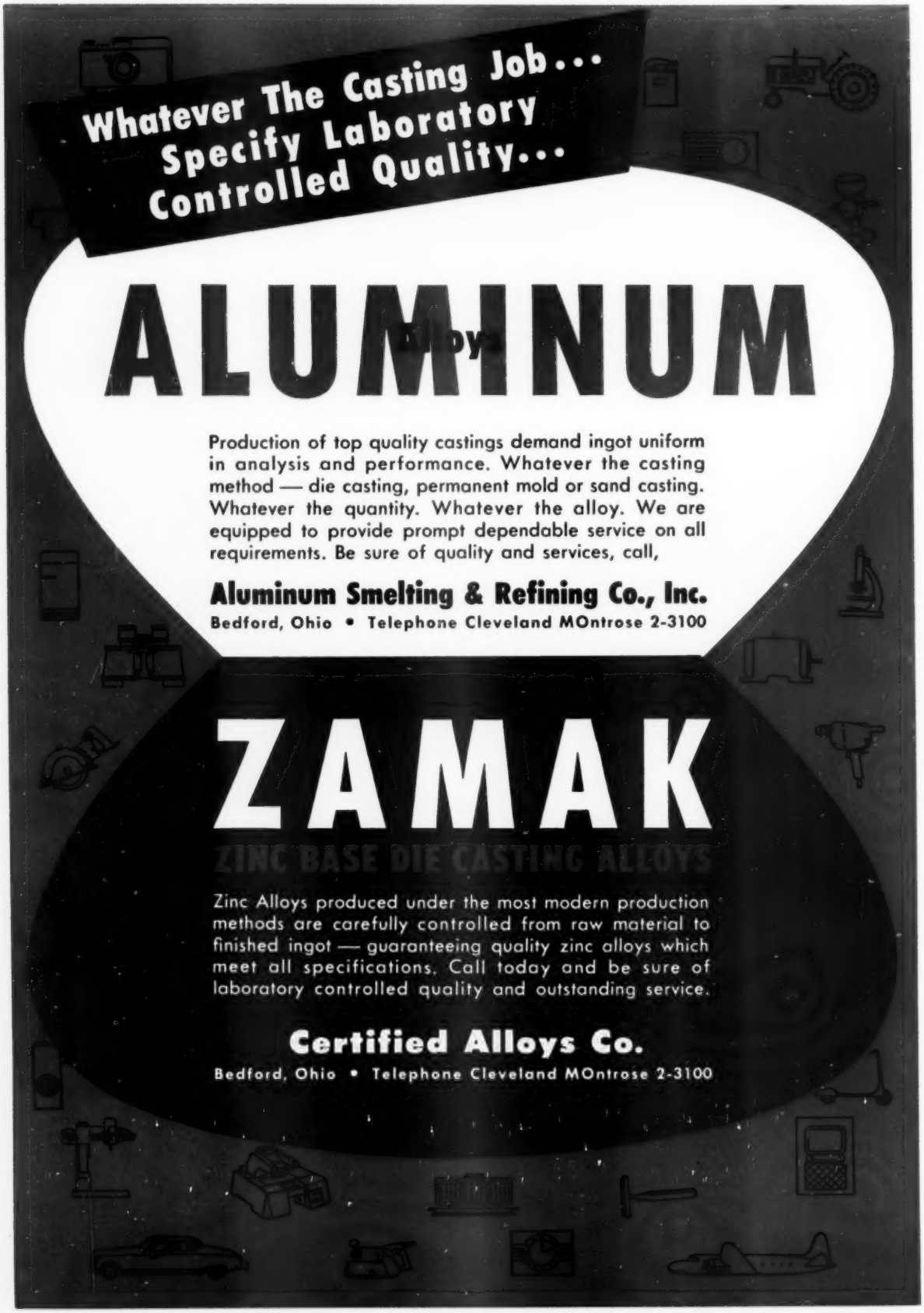
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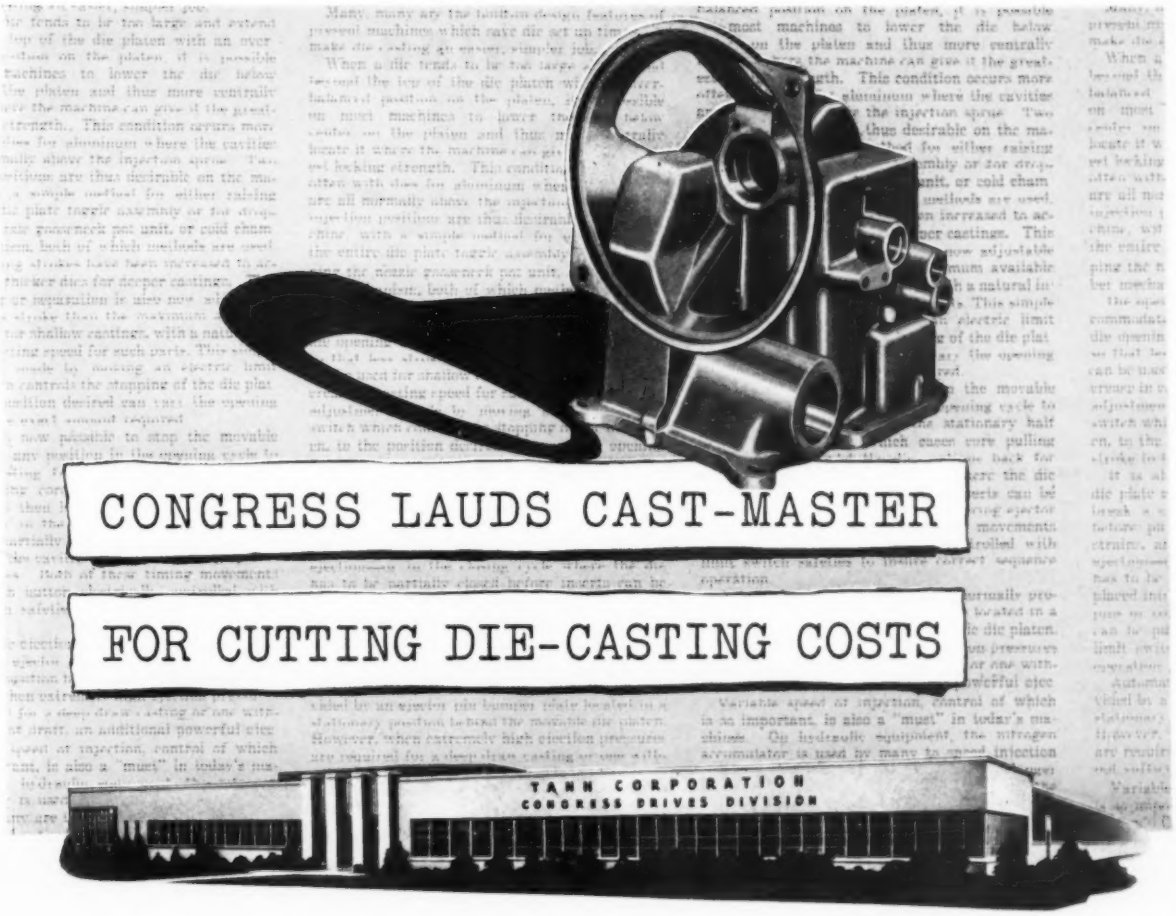

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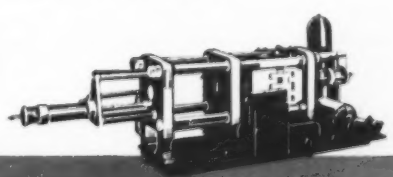

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MAY 1953
Vol. 11 No. 5

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Subscription rates: United States and possessions—$3.00 per year; $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year. Subscriptions in the United Kingdom £1.10 per annum, payable in Sterling to our London office. Single copy price 30 cents. All subscriptions subject to individual acceptance by the publisher.

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LETTERS TO THE EDITOR

MOVIES ON DIE CASTING

I am interested in obtaining one or two sound films on die casting manufacture. These would be shown in our classes in Manufacturing Processes. Do you know of any that are available, either to purchase or rent or obtain on loan? — A. M. H.

Two excellent sound films are available on the die casting process. Both are available for loan from the companies that have produced them. Information concerning these films has been forwarded, along with reference to another new sound film on the powder metallurgy process. — Ed.

BASIC DATA ON CASTINGS

The February issue of your publication has recently been brought to the attention of the undersigned. It was noticed in the latter part of the publication you offered information in booklet form on various subjects regarding castings.

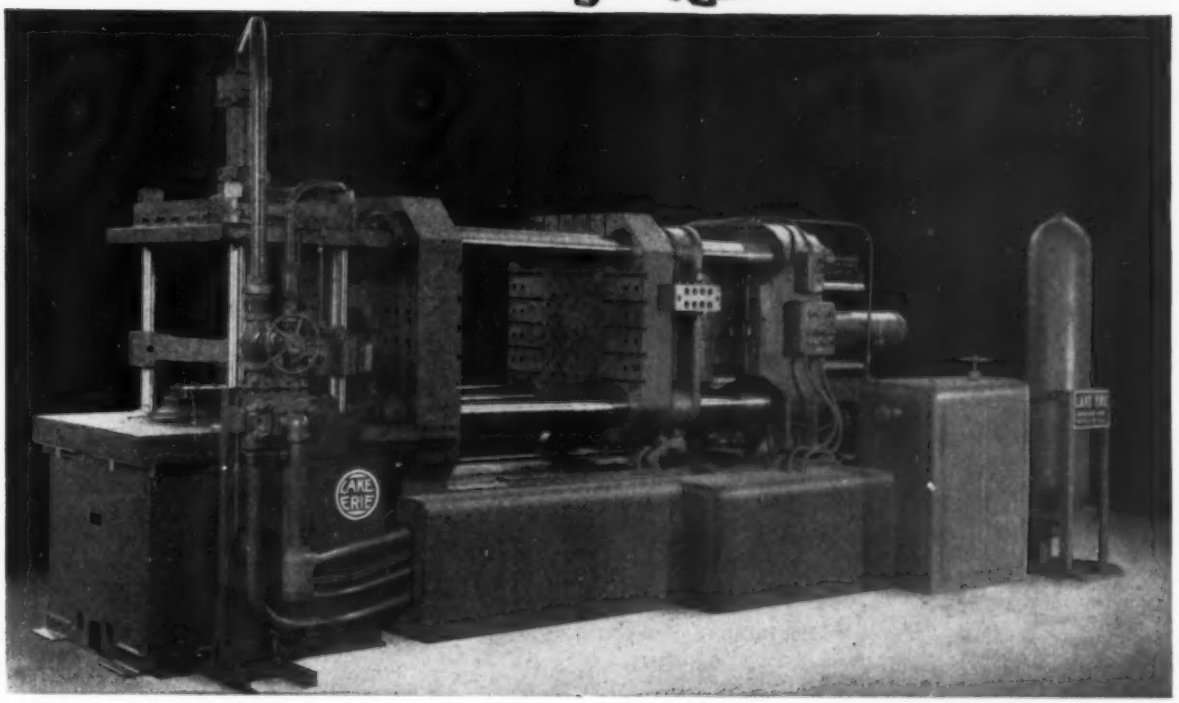
The undersigned has very little knowledge in regards to castings in general, and it is therefore requested that you forward any literature available dealing with basic fundamentals. That is, something that describes types, methods of manufacture, usage, etc. —C. F. H. (Purchasing Agent)

That is a big order, but we have forwarded several articles which have been published in PMM, requested some manufacturers to forward their descriptive literature, and furnished a brief bibliography that will give useful reference. — Ed.

continued on page 8

Have you investigated the new Lake Erie Die Casting Machines?

THESE REVOLUTIONARY MACHINES ARE INCREASING PRODUCTION AS MUCH AS **15% to 25%** FOR LEADING DIE CASTERS



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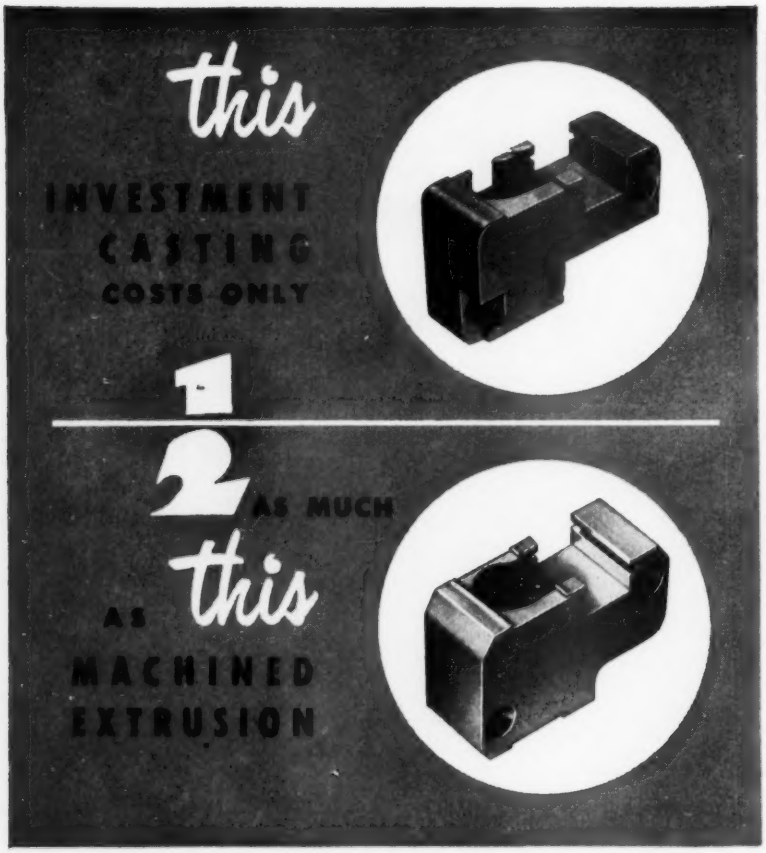

General Bronze Corporation, Garden City, N. Y., discovered that this Hitchiner-cast window lock housing gives completely satisfactory performance and eliminates the drilling and boring of a half-inch through hole and the milling of slots and dovetail recesses as well as the drilling and countersinking of mounting and set screw holes. In the investment casting only the set screw hole is drilled and tapped.

Figure it out for yourself what this saving must be and at the same time give thought to how Hitchiner Investment Castings might save you money on components for your product.

One of our technically trained representatives will be glad to discuss your problem or, if you send us drawings and specifications, we'll give you a complete engineering analysis and recommendations without obligation.

If you want your castings finished to print we can supply them through an associate company.

HITCHINER Manufacturing Company, Inc.
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For additional information Circle No. 34 on the Reader Service Card

LETTERS TO THE EDITOR
continued from page 6

FURNACE INFORMATION

Would you please forward to this firm any information on literature which you have on small (3000 lb. per 8 hr. shift) aluminum die cast metal, gas fired, remelt furnaces. It is our intention to remelt all our own generated die cast scrap and process 2S and 3S punch press scrap for die cast material. The furnace should be capable of blending in silicon to balance composition of the 12 to 13% silicon alloy. — A. L. H. (Metallurgical Eng.)

Names of manufacturers of this type of furnace have been forwarded. — Ed.

MORE ON GOLD FINISH

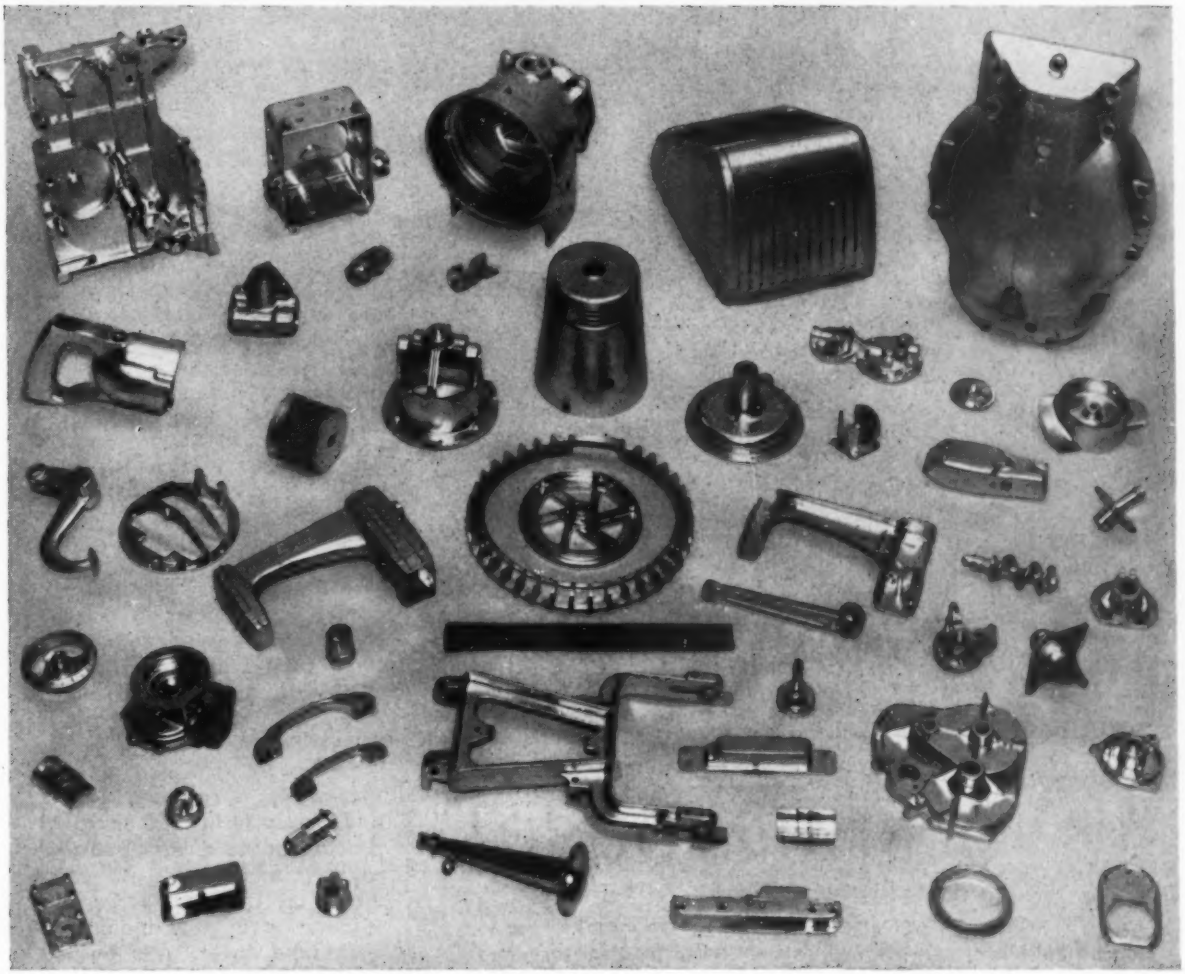
We are very interested in the article which appeared in the February issue under Letters to the Editor concerning simulated gold finish over a zinc die casting which you presented in April 1951.

We are also in the same position that Mr. F. C. C. was as we also have a similar application coming up soon. Any information you can send us regarding same will be very greatly appreciated. — K. J. E. (President)

We have had such a steady stream of requests for copies of this article on a finish which simulates gold over zinc die casting, and will withstand the moisture concentration inside a refrigerator, that our supply has been completely exhausted. We suggest that you check with United Chromium, Inc., New York, manufacturers of the specific finish referred to in the article. — Ed.

continued on page 10

LOW COST PARTS



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FOR Westinghouse!

Westinghouse Electric Corp. recently required a part for use on oil circuit breakers. Their rough blueprint called for a link composed of three separate units which had not only to be machined, but welded together.

Atlantic's engineers suggested a design that resulted in a part cast in ONE PIECE from Atlantalloy #31 High Tensile Manganese Bronze . . . a dependable engineering material that is stronger than many steels. This one piece casting eliminated the involved machining, welding and finishing steps—and consequently afforded a substantial saving over former costs.

Write for a copy of "Quality Precision Castings for Industry" today. This booklet shows how the plaster mold process cuts production costs and includes specifications on Atlantic's alloys.

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LETTERS TO THE EDITOR
continued from page 8

WHAT IS PERMANENT MOLD CASTING?

There are two processes regarding which I should like further information. The first is "Permanent Molds" and in the article on page 33 (March) it is not made clear what these are. Can you enquire if these are refractory molds and if so, how do they avoid the breaking of parts of the moulds due to metal shrinkage . . .

Secondly, I would welcome further data relating to uses made of "Frozen Mercury" Precision casting. — F. W. L. (England)

There is some difference in nomenclature describing casting processes in England and the United States. The process of casting molten metal into a steel die under pressure is called die casting in the U. S., pressure die casting in England. If the casting is done under gravity head, it is called permanent mold casting in this country, and gravity die casting in the U. K. If the casting is done in a steel mold, but with sand cores, it is termed semi-permanent mold casting.

We think that you are concerned with the process called "investment casting in which the molten metal is poured into an expendable, refractory, monolithic mold. The molds are destroyed after each cycle and are remade over clusters of wax, plastic or frozen mercury patterns. The pattern material is then burned or melted out, leaving the one-piece refractory mold.

A PMM article has been forwarded showing steps in the Mercast (frozen mercury pattern) process. — Ed.

AJAXOMATIC POURING UNIT

In Operation at Montrose Division, BENDIX AVIATION CORPORATION

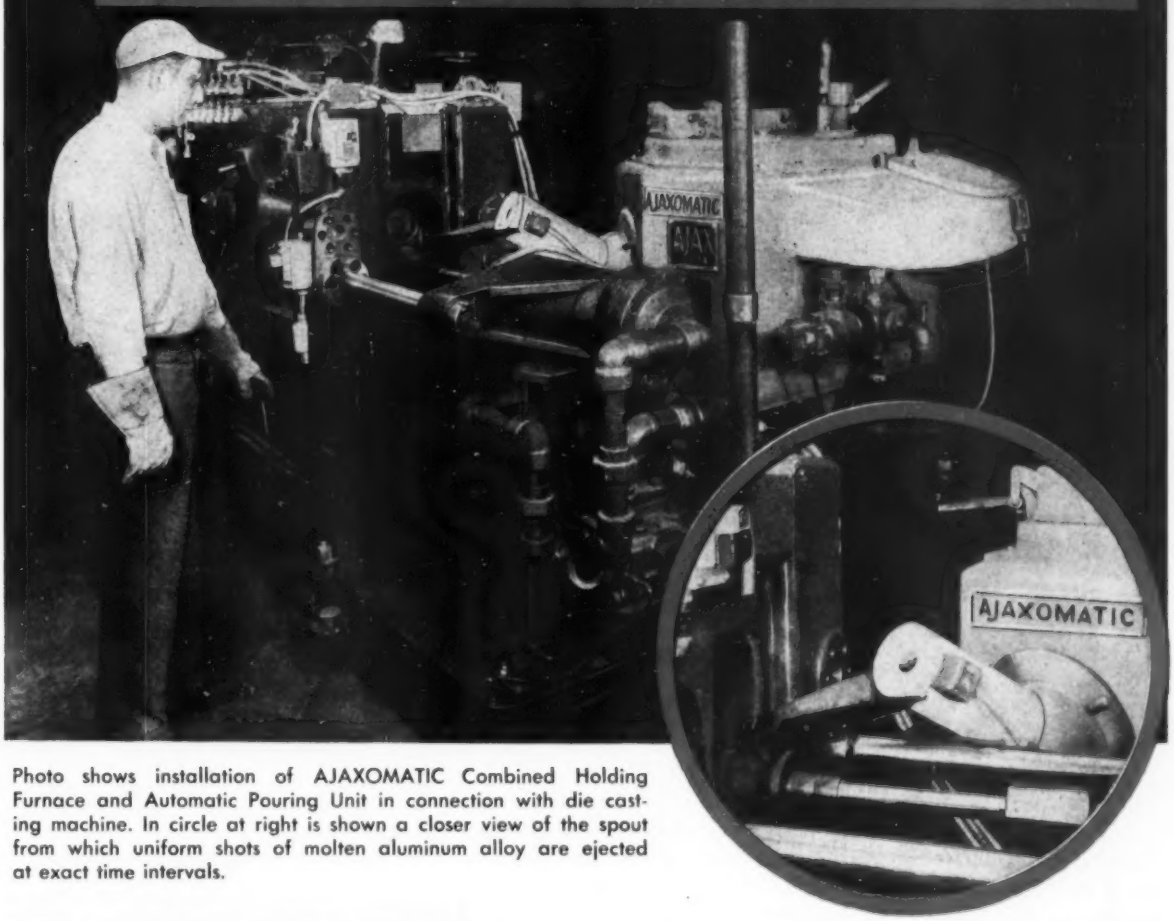

Photo shows installation of AJAXOMATIC Combined Holding Furnace and Automatic Pouring Unit in connection with die casting machine. In circle at right is shown a closer view of the spout from which uniform shots of molten aluminum alloy are ejected at exact time intervals.

NOW completely automatic die casting of aluminum alloys is possible in smaller quantities than formerly, and at reduced cost. This fact should be of special interest to the manufacturer who has die casting machines in operation and is doing hand ladling. The unit is entirely sealed, the operator feels no heat, accident hazard is eliminated.

This small, compact AJAXOMATIC* unit will increase production of die castings by as much as 25%, because it delivers regular, uniform quantities of metal into the die casting machine with no delay, immediately after dies are closed. The spout itself is heated and the temperature of each metal shot remains constant.

*Patents pending

For further information send for descriptive folder A-3

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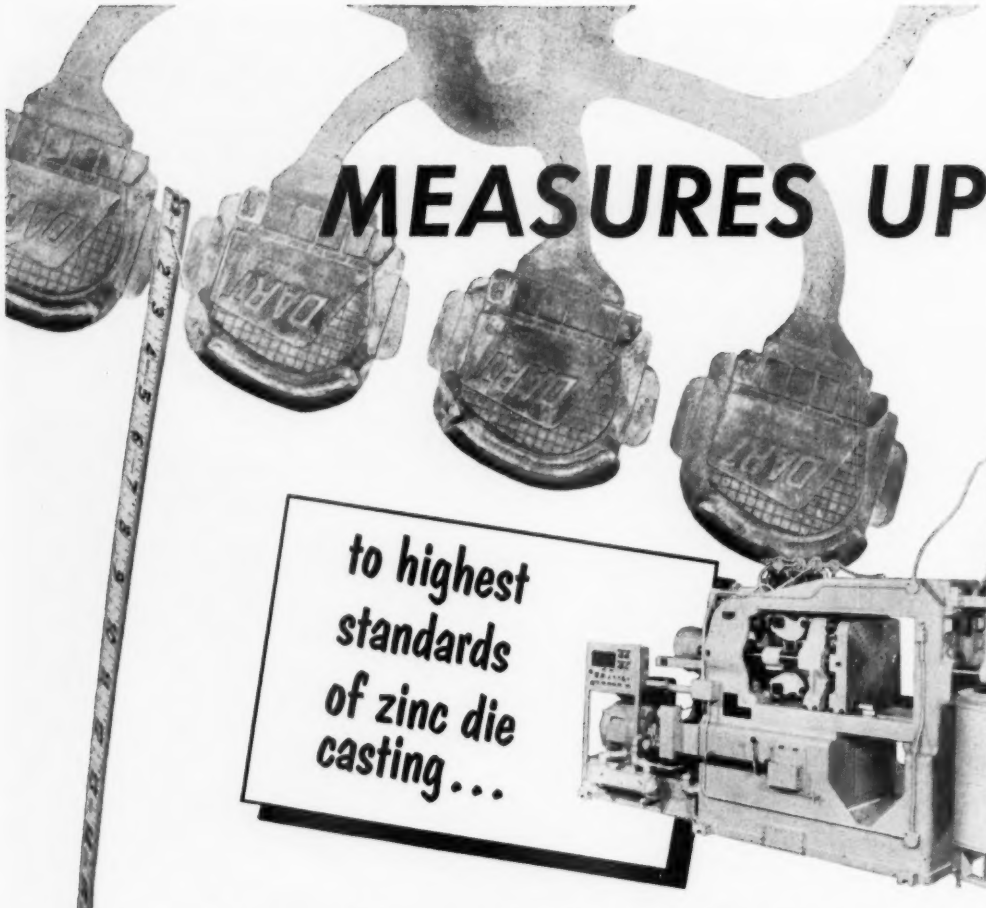
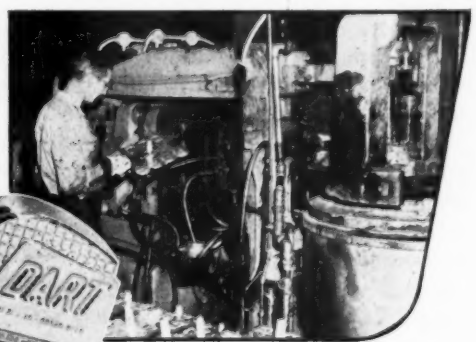
MEASURES UP!



At THE HOOVER COMPANY, in North Canton, Ohio, the production superintendent of the die casting division is well pleased with their new HP-3-Z Lester-Phoenix die casting machines.

The parts shown here, made for the Dart Manufacturing Company's steel tape is no problem when made on the Lester-Phoenix HP-3-Z machine. Hoover is pleased with the machine's production in both quality and quantity. Hoover expects to experience less difficulty on castings which are to be plated, and to experience considerably less die operating trouble.

For zinc or aluminum, the highest standards of die casting are set by Lester-Phoenix die casting machines. Write for complete specifications—and ask for a free copy of the Lester-Phoenix house organ, "The Lester Press".



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and when you think of Die Castings
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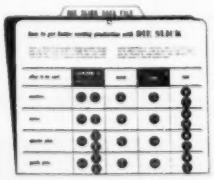
*back in 1907**

he was willing to try anything

Back in 1907 castings were less complicated, alloys less critical, and die lubrication not the problem it is today. Yet there are still a few die casters (we say a *few*, because more than 80% now use Die Slick) who try to use 1907 "homemade" concoctions for modern lubrication problems. "Snake Oil" was never really a die lubricant, but equally ridiculous compounds were tried!

Die Slick comes in five specific grades for aluminum, magnesium, brass, zinc, or lead castings. Plunger Slick is a new related product for cold chamber machines. Both Die Slick and Plunger Slick are *guaranteed!* Write for your copy of the "Die Slick Data File" today.

**The Van Wagner compressed air die casting machine pictured above (courtesy of MACHINERY) forced molten metal into the die under pneumatic pressure.*



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Between the Lines

in this and future issues of PMM

— COMPETITIVE EDGE? How does one product creep ahead of its competitors in performance, price or sales? The answer is generally found in the more efficient methods of manufacture or willingness to consider and use new materials as they are proved.

— PMM can be utilized by alert designers and company management to learn about some of the newer and more efficient ways to use metal components in their own products. Take a few examples from this issue of PMM:

— LOCK AND HARDWARE manufacturers who have been laboriously machining exterior and interior hardware from extrusions or rough castings because they need complex shapes in corrosion-resisting alloys may be overlooking a bet if they haven't considered stainless steel, aluminum or copper-base investment castings. On page 28 begins the story of a manufacturer of architectural windows and doors, and their experience converting certain lock components to investment casting.

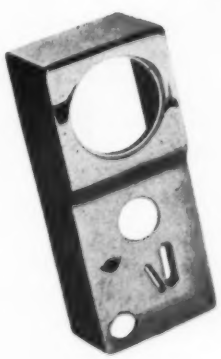
— HIGH PRICE OF TOOLS? Sometimes this has been considered sufficient reason for not investigating die castings or sinterings, even though piece prices might be lower. The specific case histories showing how die casting tooling and powdered metal tooling have paid for themselves many times over. The dollar-and-sense story begins on page 32.

— CAN PLASTIC-BONDED PAPER be replaced by metal, and if so, when? A good example of the replacement of this type of material by an aluminum die casting begins on page 40.

BRASS and BRONZE

PERMANENT MOLD CASTINGS

up to 15 pounds



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Here are a few of the advantages of Pressco brass and bronze gravity die castings:

- Elimination of sand and other inclusions which, in turn, reduces scrap loss.
- Accurate and smooth surfaces to set up from, rather than having to machine them.
- Relatively close tolerances eliminate or reduce machining, reduces amount of finish stock to be removed, and thereby, permits cheaper machining methods and longer tool life.
- Steel inserts can be cast in place.
- Higher physical properties than possible with sand castings can be obtained, using same alloys, due to rapid chill from steel molds.
- Use of sand cores in steel dies permits complex interior while maintaining smooth exterior.

PRESSCO

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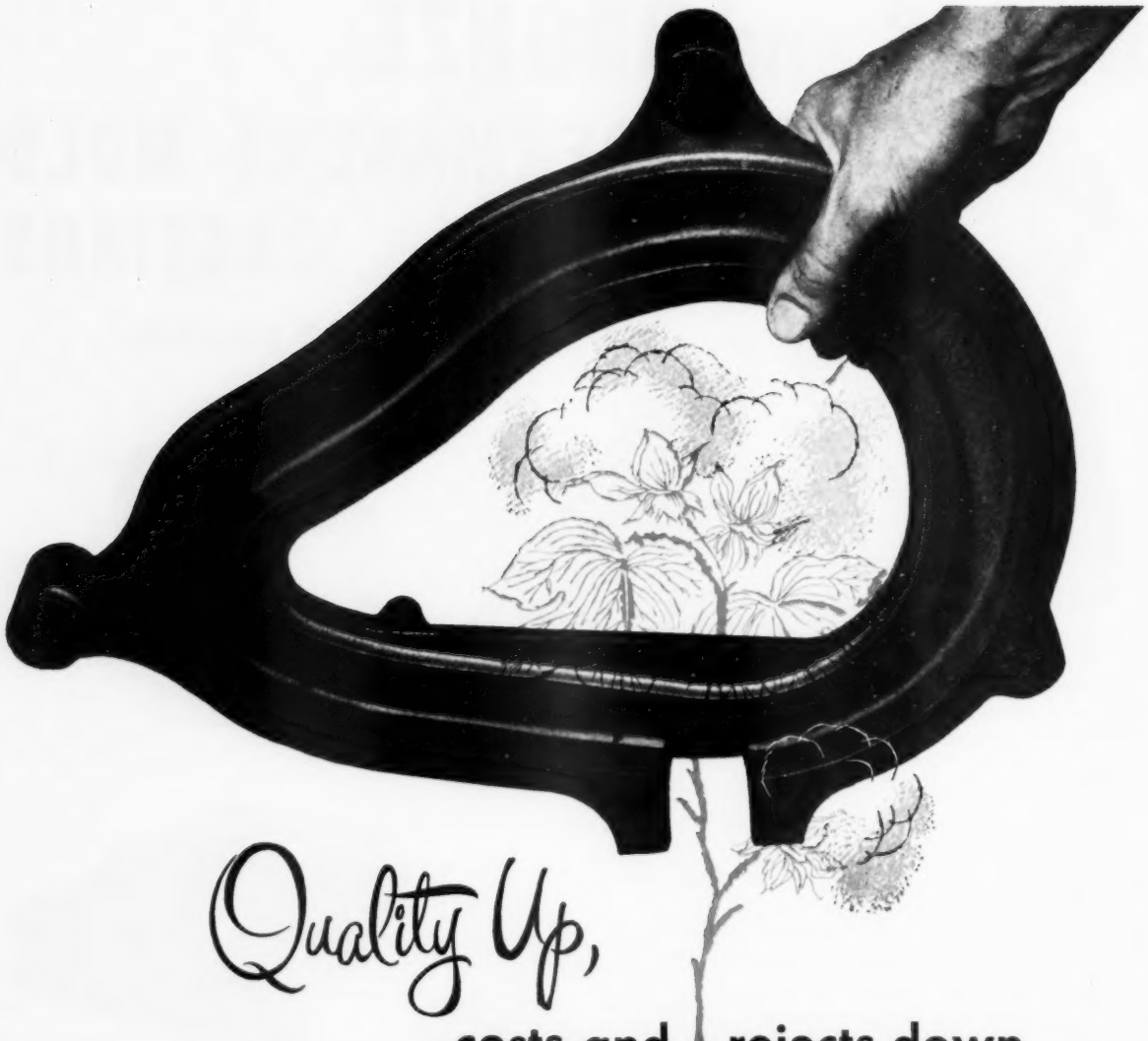

Quality Up,

costs and rejects down
WITH CRUCIBLE TOOL STEEL CASTINGS

The steel part shown above used to be a production headache. A cam for a cotton picking machine, it was originally flame cut from SAE 8730 boiler plate, machined and heat treated. Other difficult steps included end-milling and finish-grinding the cam track. Rejections were high, because the cam often warped during heat treatment.

The problem was solved by casting the cam in Airkool®, a Crucible air-hardening tool steel. When the customer receives the casting from Crucible, all he has to do is finish it, mill the cam track and heat treat. He doesn't have to finish grind – Airkool is non-deforming when properly hardened and tempered. Machining costs are way down and quality is up, since Airkool resists wear far better than the low alloy steel from which the part used to be made.

Crucible's casting facilities often make it possible to use wear- and abrasion-resisting tool steel for complicated machine parts. We may be able to help you just as we helped the cotton picking machine manufacturer. Get in touch with Crucible today!

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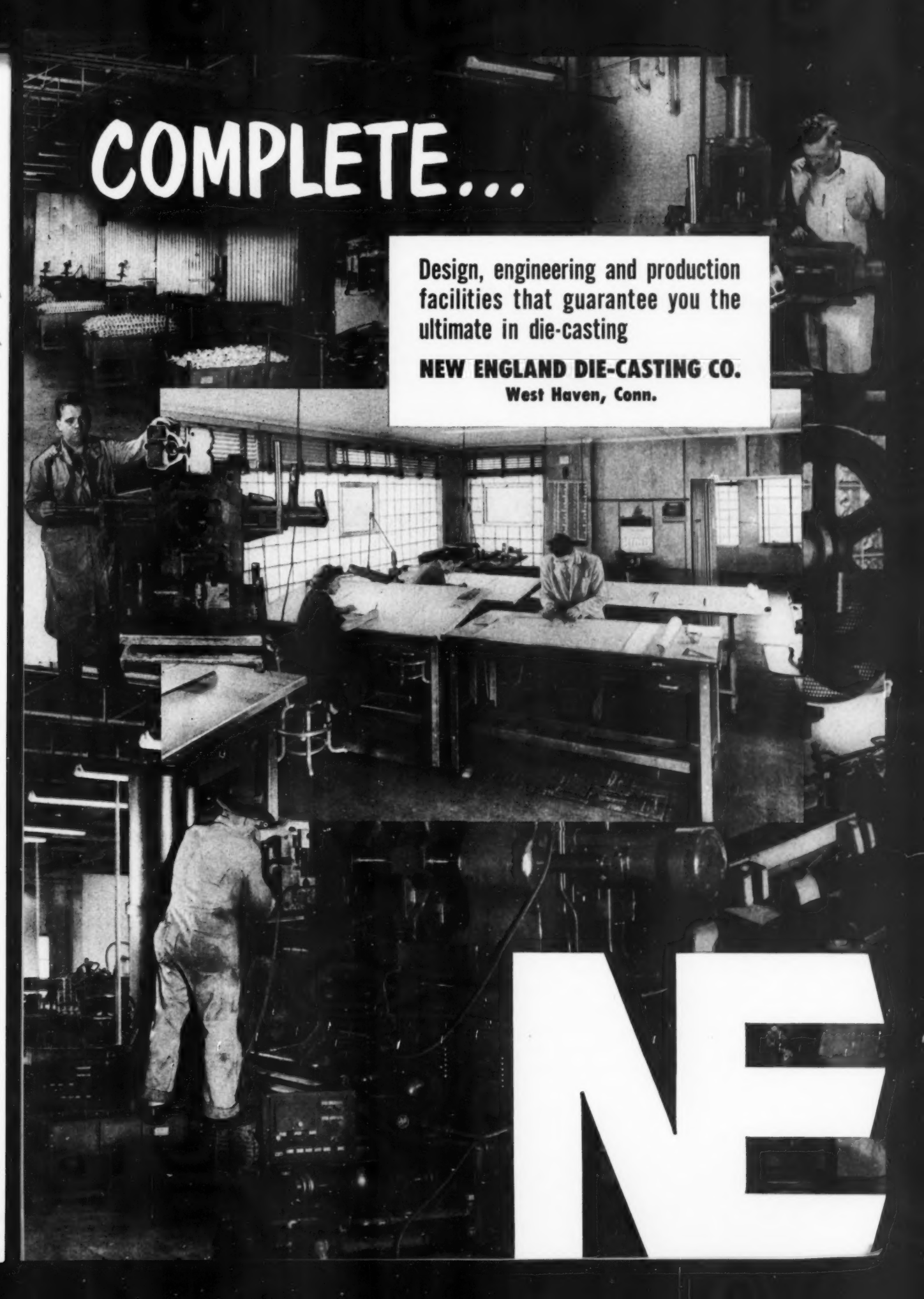
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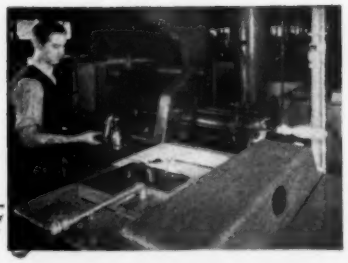

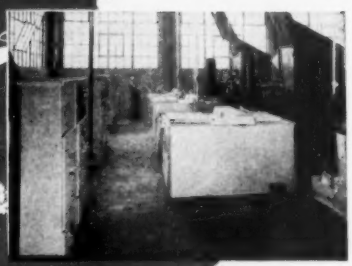

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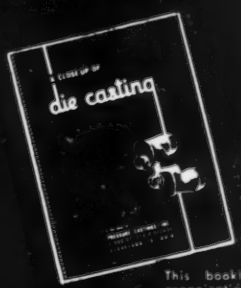

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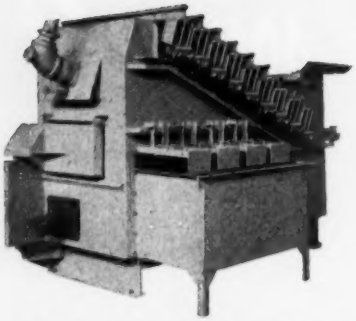

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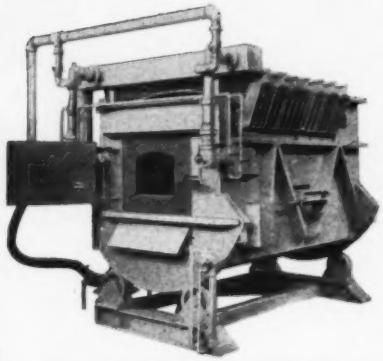

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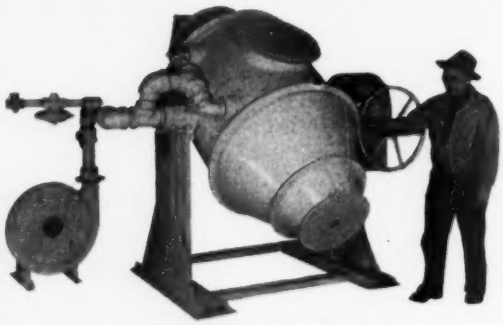

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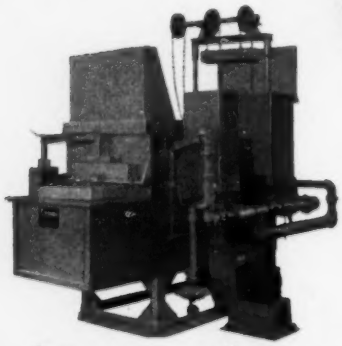

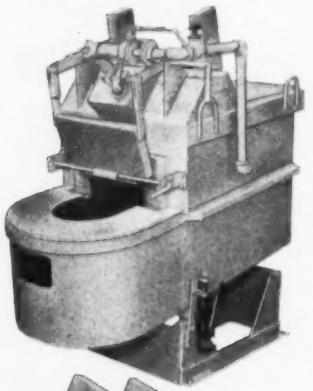

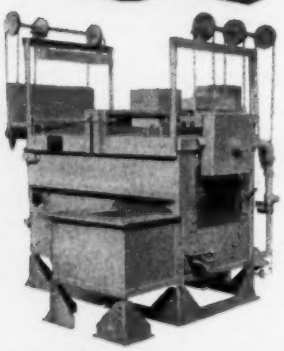

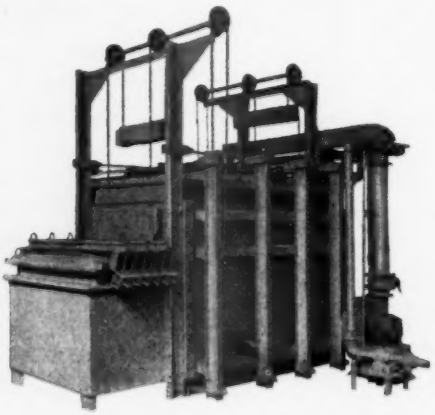

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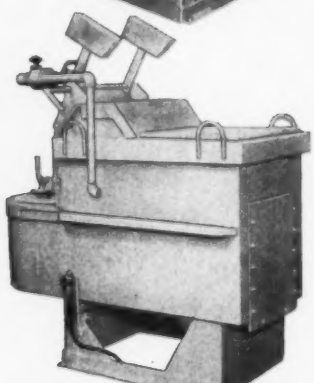

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"Very pleased" with Mount Vernon Die Casting

CASE HISTORIES FROM MT. VERNON FILES

The tools shown here are Porter-Cable Machine Co's. Model 503 Sander and Model 511 Router.

Says Porter-Cable: "All of the castings for our No. 503 Sander and No. 511 Router are made by Mount Vernon Die Casting Corporation, and we are very pleased with the work done for us by this die-caster. The main frame on the sander required an especially difficult die, and Mount Vernon did an excellent job.

We find that die casting the parts which house our portable tools enables us to—

(1) **hold down weight to a minimum;**

(2) **lower cost of tooling**—since die casting can be held to such close tolerances that many machine operations can be eliminated;

(3) **get high quality castings at reduced costs;**

(4) **obtain faster deliveries**—permitting us to step up our own production schedules."

Here are compelling reasons why die casting merits serious consideration by every manufacturer with a metal product in the blueprint stage.

If you'll send us your specifications, we'll gladly put our long experience and specialized knowledge at your disposal . . . go to work to **please you in every respect,** just as we have pleased Porter-Cable.

MT. VERNON
DIE CASTING CORP.
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When Pressure replaced Gravity
DIE CASTING WAS BORN

Early Die Casting Machine in Operation

The production of castings by pouring molten metal into sand molds is an ancient art. The jewelry industry's requirements for smoother castings with sharper outlines, resulted in the development of a process utilizing plaster molds. In either case, however, the removal of the cast part necessitated the destruction of the mold. The search for a permanent mold for the quantity production of repetitive parts bore fruit in the Middle Ages when manufacturers of pewterware developed molds made of iron. In the 1800's so-called tin soldiers were also gravity-cast from hinged iron molds.

The next logical step was to improve the accuracy of cast parts by forcing molten metal under pressure into strong steel molds, instead of merely relying on gravity. This eventually led to the development of the linotype machine by Ottmar Mergenthaler. The basic principle of the linotype machine — pumping metal into a permanent mold by means of a plunger submerged in liquid metal — was adapted and embodied in the first die casting machine at the start of the century, and the first commercial die castings, such as automotive bearings, were produced from tin and lead-base alloys.

When early die casting experimenters — called upon for castings with better mechanical properties — turned to zinc as a base metal, little did they realize that zinc base die castings would finally advance to a point where they became a vital factor in modern engineering processing. Least of all would these pioneer die casters have foreseen that in a relatively short span of years their infant-industry would be outranked only by the galvanizing industry as the country's largest consumer of zinc.

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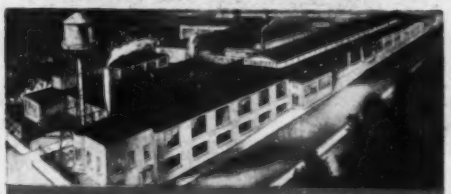

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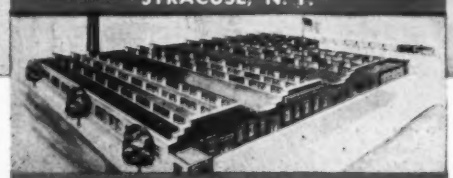
FAYETTEVILLE, N. Y.
MAGNESIUM PLANT

FAYETTEVILLE, N. Y.

SYRACUSE, N. Y.

SYRACUSE, N. Y.



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9 Completely Equipped Plants!

Out of these nine Precision plants comes a constant stream of top quality die castings to keep the production lines of industry moving to new high production peaks. Large and small users of die castings are assured of on-time deliveries of the best die castings they can buy.

Precision know-how in producing better die castings plus superior plant facilities can help you meet your production and sales quotas.

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for maximum tool usage
at minimum cost
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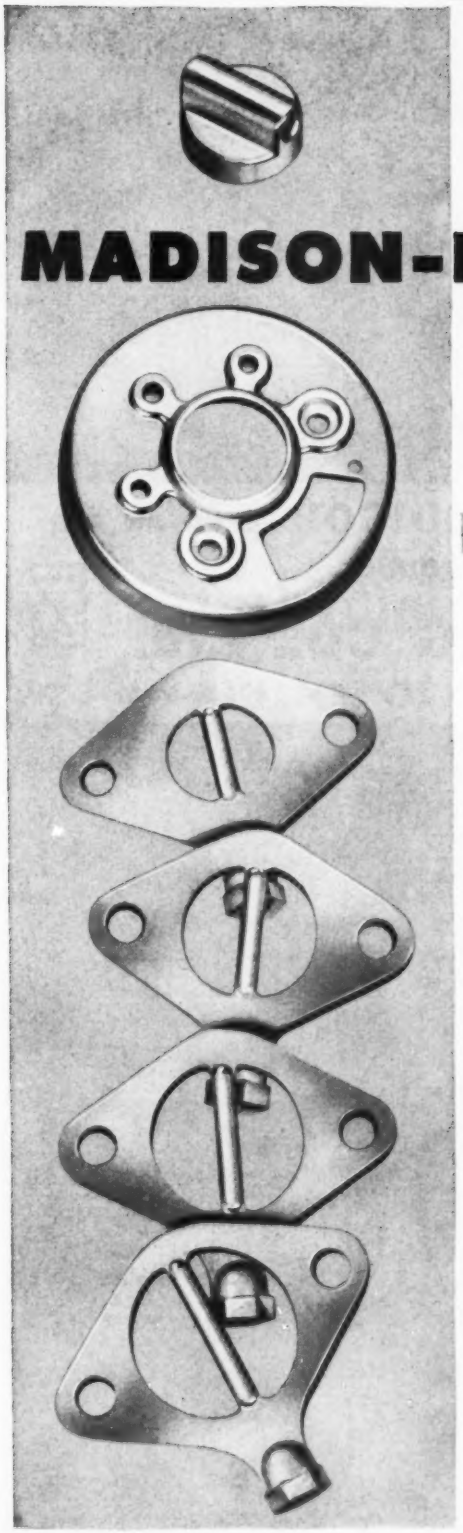
ZINC AND ALUMINUM DIE CASTINGS



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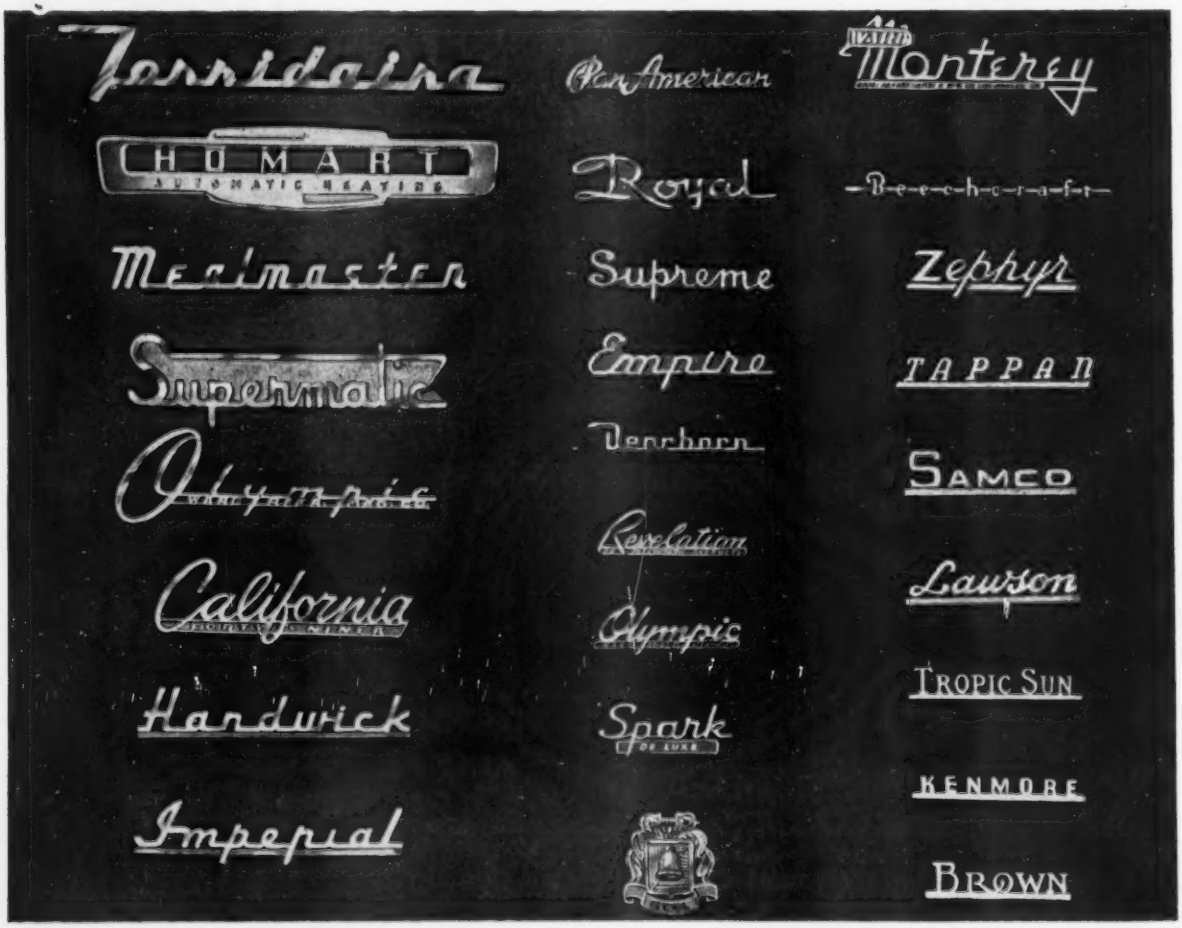


For additional information Circle No. 24 on the Reader Service Card

"This magnesium die casting is a sample removed from a car after 40,000 miles on the road. More than 1,750,000 castings have been produced so far from a four-cavity die . . "

AFTER 40,000 MILES – Report on the performance of a magnesium die casting

MAGNESIUM die castings have now been used in normal automotive applications for a long enough period of time to permit an examination and evaluation of their record. Originally they gained acceptance largely on the basis of competitive cost and some accelerated testing, but are finding additional applications now that the auto builders have been able to watch them in service.

One of the more interesting magnesium die castings on which some service information is available is a fan spacer used on several leading automobiles. The casting illustrated in the unretouched photograph, above, is a sample removed from a car after 40,000 miles on the road.

It was cast in Alloy AZ91A and protected only by a conventional chrome pickle. This spacer is mounted between a cast iron pilot from the water pump and a steel fan. After two years exposure, there is so little corrosion as to be negligible. No dimensional changes are recorded and its metallurgical structure appears to be unaffected by time or weather.

This piece was, at one time considered being cut from extruded stock. It would have required six machining operations to cut, turn and bore. On the die casting, only one operation — boring the pilot which is cored — is required.

Cost of the extrusion without any machining would have been about the same as the cost of the die casting ready for finish boring.

How accurately is this piece cast? The most critical dimensional relationship is the concentricity between the boss which can be seen in the illustration, and the pilot bore on the opposite side of the casting. Since these occur in opposite halves of the die, it would not be possible to cast them to close enough concentricity. Also, the faces muse be parallel to .003. Thus, a powerful casting machine is required to limit die separation.

However, the boss is cast to dimension within ± .001 and the casting is located from this boss while the pilot hole is bored to .628 — .630 in the other side. The four bolt holes are cored in accurate location.

According to the die caster producing this casting, Litemetal Dicast Inc., the four-cavity die from which the spacer is cast has run more than 1,750,000 castings. Tolerances have been held throughout the run, with the original die still in operation.

One factor said to help in holding accuracy is the fact that there is less variation in solidification shrinkage than with aluminum.

LOCKS and other hardware for casement windows and doors have many components that are frequently machined from extrusions or bar stock at great cost. Here is a suggestion for the designer of architectural hardware: Why not try an investment casting to save money?

ARCHITECTURAL HARDWARE: new use for aluminum and stainless steel investment castings

By H. A. HEITZMANN*

ARCHITECTURAL uses for investment castings have received little attention, although this process is being applied to fabricate aluminum, stainless steel and copper base alloys into some of the more complex shapes required for building hardware.

During copper shortages in recent years, a search for an alternative for heavily-machined phosphor bronze rod or extrusions led one major builder of metal windows to investigate, test and introduce investment castings in window locks. It was found that these castings gave completely satisfactory performance at lowered cost, while reducing in-plant processing.

The Texaco Building in New Orleans and the Gateway Building in Pittsburgh, among recent structures for which windows have been fabricated by General Bronze Corporation of Garden City, N. Y., include thousands of investment cast lock components in aluminum and stainless steel.

General Bronze is no stranger to the investment casting process; in its early history, it used the ancient "lost wax" casting techniques of Benvenuto Cellini to produce architectural bronzes and decorative plaques. A few years ago, General Bronze discontinued this art foundry operation, but has turned for castings to a specialist in the investment casting process which is a recent industrial refinement of the more ancient craft.

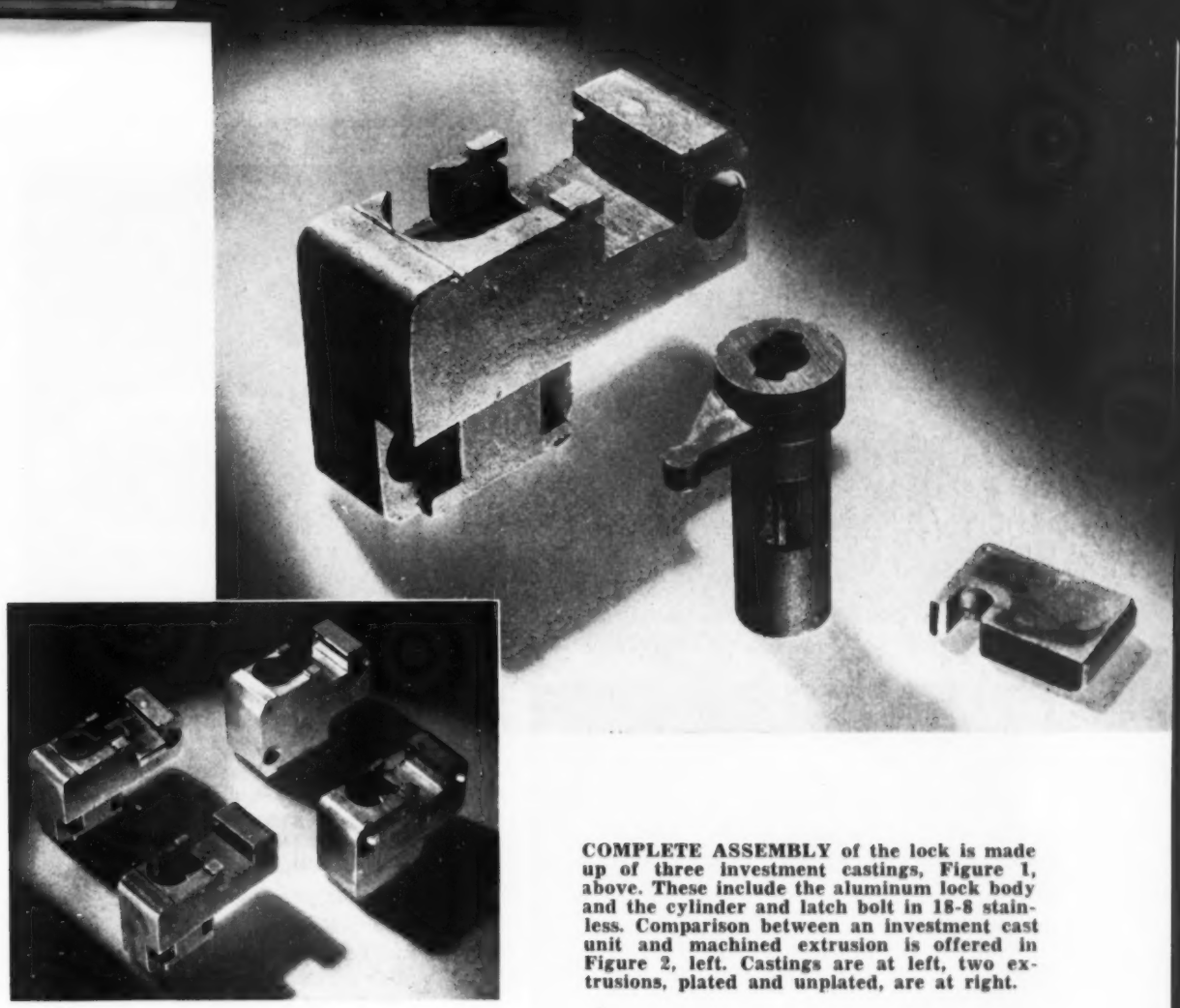
Today, the production of castings by "lost wax" methods, whether the expendible patterns are of wax or polystyrene, has metamorphosed from an art to a technology and is used for close reproduction of complex shapes in mass production quantities.

These investment castings used by General Bronze are displayed in Figure 1, and were produced for them by Hitchiner Manufacturing Company, Inc., of Milford, N. H.

The lock housing is cast in a silicon-magnesium alloy of aluminum, with commercial designation No. 356. The latch cylinder and latch bolt are investment cast in 18-8 stainless.

Most impressive for its complexity and, therefore, the amount of machining saved, is the lock housing. In Figure 2 the investment cast housing is presented along with the machined extrusion which it replaces. Some of the machining operations are indicated,

*Assistant Purchasing Agent, General Bronze Corp.



COMPLETE ASSEMBLY of the lock is made up of three investment castings, Figure 1, above. These include the aluminum lock body and the cylinder and latch bolt in 18-8 stainless. Comparison between an investment cast unit and machined extrusion is offered in Figure 2, left. Castings are at left, two extrusions, plated and unplated, are at right.

including the drilling and boring of a half inch through-hole, milling of slots and dovetail recesses, drilling and countersinking of mounting and set screw holes. In the investment cast housing, only the set screw hole is drilled and tapped because of its location.

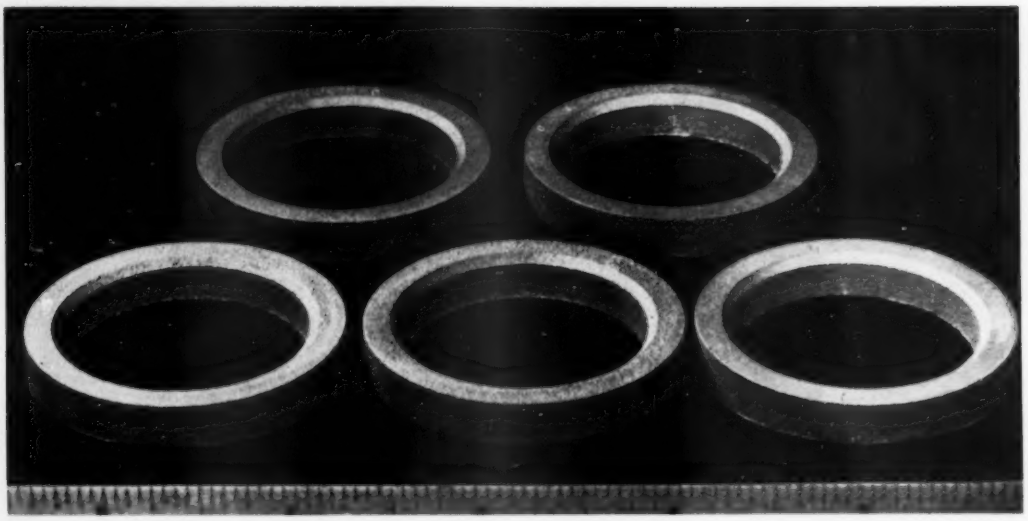
On the first order of 17,000 pieces, including amortisation of tooling costs, the finished piece price of the investment casting was considerably less than that of the machined extrusion.

Certain changes in piece design were suggested by the casting vendor to gain maximum advantage from the casting process. The inclusion of metal reliefs not only has reduced the weight of metal, but also improves the soundness of the cast structure.

Two stamped plates used to retain the latch cylinder inside the housing were inserted into the extruded housing by means of dovetail grooves, as indicated in Figure 2. These dovetail grooves were specified on the prints for the investment casting. However, the vendor suggested a change in shape of the dovetails to avoid the sharp angle, without affecting the function of the piece. The revised dovetail design can be seen in Figure 1.

Corrosion resistance under conditions of severe exposure to weather are, of course, a basic requirement of builders' hardware such as these locks for reversible windows. On the bronze extrusion, it was necessary to cadmium plate to prevent electrolytic action, but the aluminum and stainless steel castings need no such processing to protect them.

Many parts in the manufacture of architectural windows and doors may lend themselves to the investment casting process. This is especially true where a large number of secondary operations are required, starting with bar stock, extrusion, forging or rough sand casting. Quantities, too, must be such that cost of pattern dies can readily be written off within the margin of savings.



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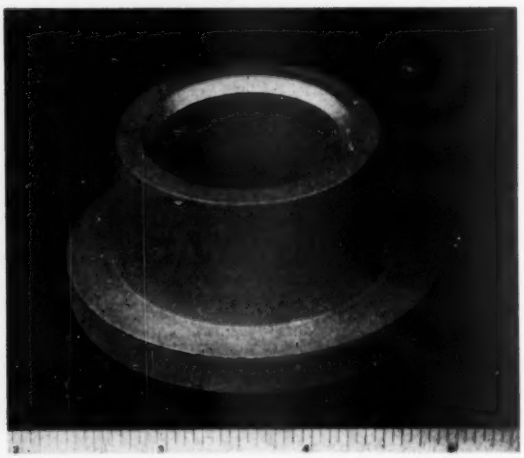


"IN ITS ORDINARY FORM, the process is limited to simple cope and drag mold sections such as the automotive valve seat castings, above, and the diesel fuel injector seat casting, left . . . "

2.

The PLACE OF SHELL MOLDING as a precision casting method

By R. A. KEMPE*

SHELL mold casting, a new and promising process, is gaining in momentum and is well on its way to an increased volume of production. The shell mold process is coming into its own well heralded. Much of this heralding is sound and good, but some is ballyhoo and can be dangerous to the future of the process. It is definitely hoped that shell molding will find its proper place in production without having to overcome the prejudice caused by early overselling which too often accompanies new production methods.

Castings with relatively good accuracy and surface finish can be economically produced by shell. Hence it is certain to gain a permanent place in the family of casting methods,

*Sales Engineer, Metallurgical Products Div., Thompson Products, Inc.

although it will not obsolete any presently established process. There is no interest here to discuss technical aspects of tooling for or producing castings, but rather to summarize facts about shell castings which will offer some guidance towards proper application.

Dimensional reproducibility

In general, tolerances of ± .005 inches per inch can be maintained on dimensions which do not transcend mold parting lines. Limits on dimensions across parting lines should be at least ± .010. Limits on reproducibility across the parting lines are not a linear function of the dimensions but rather are general and depend more upon casting bulk and the intricacies of the fit of the mold halves. These general tolerances can be used as design guides. Other design factors will make it possible to improve on them in some cases as well as require them to be broadened in other instances.

The metal patterns used are usually completely stable throughout the operation, and the mold is "set" while still in contact with the pattern. It follows that almost all variations on within part line dimensions can occur from sand abrasion, but periodic inspection of patterns can help minimize this.

Surface Finish

The high quality of surface finish of shell mold castings is one of its major advantages as well as being the dominating factor in the dimensional accuracy of the process.

Finish is highly dependent upon the alloy being used. Below are typical profilometer results on materials cast into shell molds.

18-8 Stainless Steel	125-150 rms
Bronze	90-115 rms
Aluminum	50- 75 rms

It can be seen that the finish of the lower melting alloys is superior. This is because the violence of resin burnout during casting is a function of metal temperature. The alloys reported here are all relatively oxidation resistant. Less resistant materials give poorer finishes because of scaling during cooling and in subsequent heat treatment.

Comparison with other methods

In its ordinary form, the process is limited to simple cope and drag mold sections. Figures 1 and 2 are ring castings which are typical. Techniques of setting cores into shell molds have extended the field into some fairly intricate parts.

Briefly summarized in Table 1 is a com-

continued on page 71

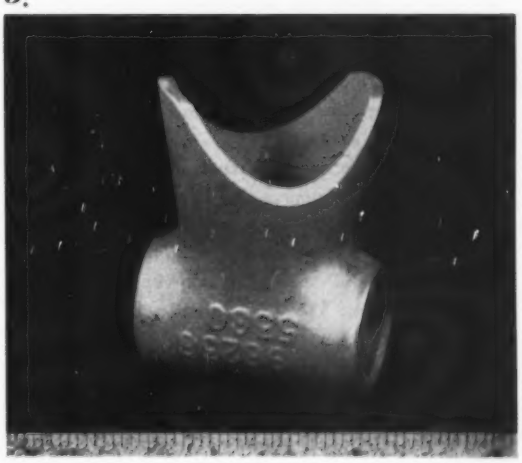
Case history of shell molding

THREE STAGES in the development of an aircraft exhaust manifold are shown below, from top to bottom, sand casting, investment casting from frozen mercury patterns, and shell moldings. Photos courtesy Thompson Products Co., Metallurgical Products Div.

3.

4.

5.



TOOLING PAYS FOR ITSELF in die casting and powder metallurgy

By T. C. KEYES*

IN order to achieve the best results from any cost research and analysis, there must be complete cooperation between the various in-plant groups. Design, engineering, testing, purchasing and cost accounting must work together if the most is to be made of any cost research. Cost research as practiced at Massey-Harris Co. of Racine, Wisc., is showing some remarkable cost reductions.

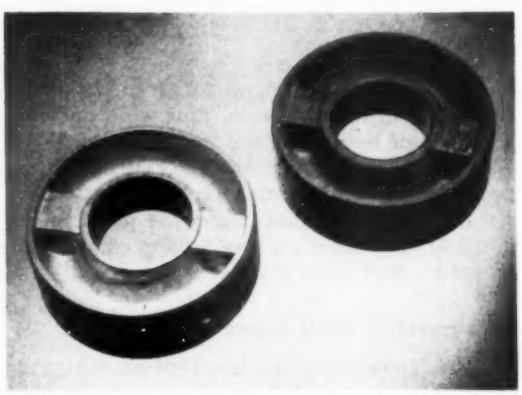
To demonstrate how a well-functioning team can operate to reduce manufacturing costs, a few typical examples of cost research are given.

These three examples are typical of many being carried on all of the time at Massey-Harris Co. They show not only how costs can be reduced, but how machine burden can be lowered by changing the method of manufacture and perhaps the material from which a part is being made. Not all analyses show such happy results, but the value of carrying on a continuing program of this sort will invariably lead to cost reductions, many of which will be of major proportions.

Part: Oil Baffle
Old Material: Cast Iron
Proposed Material: Zinc Die Casting
Tested and found satisfactory by Engineering Department.

Machined casting, cost per 100	$ 74.51
Die casting, cost per 100	35.07
Savings, per 100	39.44
Annual savings	1897.06
Tooling—one single cavity die, one trimming die	785.00

Thus, for an investment of only $785.00, an annual saving (based upon constant volume) of $1897.00 is realized. As is common practice, the initial tooling cost is for permanent dies and all replacement and maintenance is carried by the foundry. Costs resulting from any design changes necessitating a change in tooling is, of course, carried by the purchaser.



*Cost Research Dept. Massey-Harris Co.

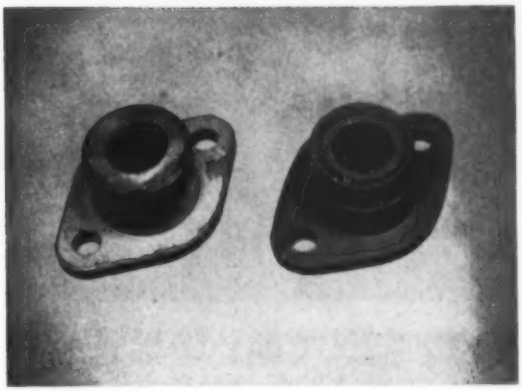
Part: Clutch Release Fork Flange

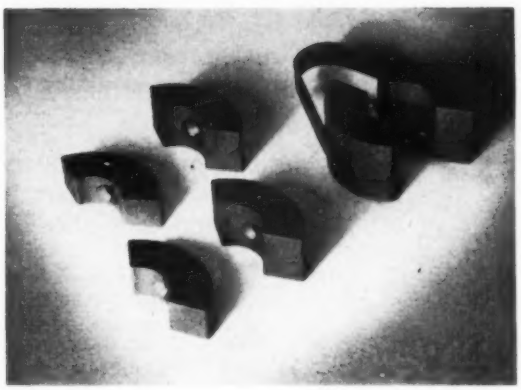
Old Material: Cast iron with self-lubricating bearing pressed in.

Proposed Material: Iron sintering, oil impregnated. Tested and approved by Engineering Department.

Machined casting, cost per 100	$ 53.02
Sintered part, cost per 100	29.50
Estimated savings per year	7927.26
Tool costs	935.00

As in the previous case, a careful cost research and analysis has come up with a different method of manufacture at a very worthwhile saving in manufacturing costs.





Part: Ram Stroke Stops

Old Material: Steel bar stock

Proposed Material: Iron copper powder mixture. Tested and found satisfactory by Engineering Department.

Manufacturing cost, per 100 old method	$15.00
Manufacturing cost, per 100 new method	
Large stop	4.90
Medium stop	4.30
Small stop	3.10
Tooling costs	$650.00 to $700.00

Cost Research Reveals Vast Market

Editor's Note: Figures made available on these pages by the Cost Research Department of Massey-Harris are in line with findings of a nation-wide survey conducted by PMM.

This survey, published in the April issue of PMM, page 29, revealed that nearly 400,000 tons of small (under one pound) gray iron castings have enough secondary operations to justify redesign to one of the more precise molding methods. The majority of these small gray or malleable iron castings are produced in quantities large enough to justify tool costs for die casting dies or powder metallurgy dies.

Where the materials available will meet physical requirements, die cast zinc and aluminum and sintered iron are being studied by companies such as Massey-Harris for possible conversion. Lower cost for equal performance is the keynote.

Can Sinterings be used in AUTOMOTIVE HYDRAULIC PUMPS? Tests show they can

PERFORMANCE characteristics of iron-copper sinterings intended for use in hydraulic pumps have been studied closely by Michigan Powdered Metal Products Company. This has been part of the development work to determine whether the amount of hydraulic fluid leaking through a coined sintering is sufficient to influence its efficiency.

Tests have been conducted to determine fluid leakage through a coined iron-copper sintering used as the piston in a reciprocating type pump (not illustrated). Findings of this test, presented in Table 1, reveal such negligible fluid loss that it can be said to have no effect upon the unit's efficiency.

Loss by leak through, under conditions outlined in Table 1, was found to be 0.00688 percent. In the design of a reciprocating pump where time relationships are important, this leak-through percentage is useful in calculating pump efficiency.

On gear-type pumps, operated only occasionally, the time cycle is relatively unimportant and therefore, leak-through is not of critical importance. This type of pump is used for operating automotive accessories such as car windows and convertible tops.

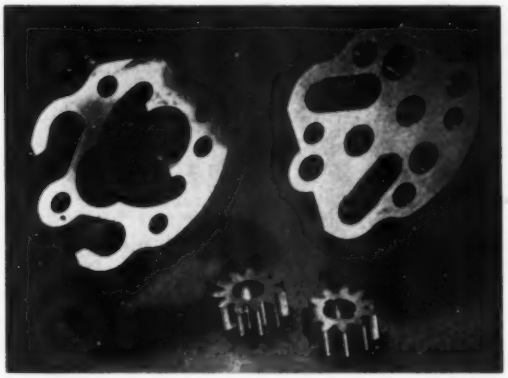
In components which must be completely sealed, impregnation by means synthetic material is practical and can withstand up to 100 psi air used to prepare sinterings to pressure, equivaltent to about 1000 psi hydraulic pressure.

Table 1

CALCULATION OF LEAK OF OIL THROUGH SINTERED IRON-COPPER PISTON WITH MINIMUM DENSITY OF 5.7 G/CC

Estimated leak rate for SAE 10W oil at 1000 psi on air permeability at 60 psi:

Area factor	2.32	
Viscosity factor	1.7×10^{-4}	
Length of path factor	0.2	
Pressure factor	13.6	
Expected oil loss in one 5 sec. cycle		0.003 in.^{3}
Effective area of piston		10.9 sq. in.
Effective thickness of piston		0.5 in.
Volume of 4 in. stroke		43.6 in.^{3}
Percent loss by leak-through:	$\frac{.003}{43.6} \times 100 = 0.00688$	



1. PRESSED, SINTERED AND COINED from iron-copper powder, these four parts make up the body, cover and gears of a gear-type hydraulic pump.

2. CLOSE FIT OF COMPONENTS without machining can be achieved through a coining operation that produces close tolerances and increases density.

How sinterings are being used in hydraulic pumps

A gear pump now widely used in the automotive industry to actuate car windows and convertible tops is built of five iron-copper sinterings, Figures 1-3, produced by Michigan Powdered Metal Products.

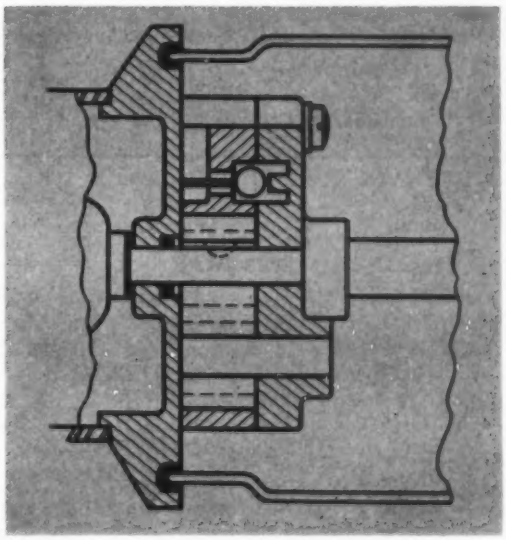
The pump is a 6 volt, DC, motor-driven gear pump designed to deliver not less than 1.8 gpm of a specified brake fluid. Current consumption should not exceed 135 amps, and minimum hydraulic fluid pumped is specified as:

Pressure, psi	Fluid, gpm
100	1.3
150	1.3
200	1.0
240	0.5

The powder chosen for pressing these pump parts has a composition consisting of 85.4 iron (min); 6.0 - 12.5 copper; and 3.30 other (max). It is the same powder composition as that tested in the piston for a reciprocating pump referred to in Table 1.

Sintered parts include the driver and idler gears, the gear housing, gear cover and end plate. All of these pieces are coined after sintering and one of them, the end plate, is also impregnated with polystyrene.

3. IMPREGNATION SEALS this sintered end plate to prevent any seepage of hydraulic fluid. Polystyrene impregnant is used.



4. SECTION VIEW of the pump assembly reveals the relationship of the sintered pump parts.

SINTERED GEAR PUMP — cont.

Coining is an optional third step in the powder metallurgy process, following briquetting and sintering. It is used for three purposes, in general: closer tolerances, increased density and higher tensile strength.

The coining of these pump sinterings is done only for improvement in dimension and density, since the additional strength is not required for this application.

It is interesting to note the corrolation between density and tensile strength. At density of 5.7 g/cc, these iron-copper sinterings have a tensile strength of 25,000 psi. This rises to 32,000 psi when density is increased to 6.2 g/cc.

Physical properties of this material* are listed as follows:

Hardness	28 Rockwell B (min)
Porosity	18-25 percent
Density	5.7 - 6.2 g/cc
Tensile strength	25/32,000 psi
Compression	40,000psi per .005 offset

Close tolerances are essential in the operation of the gear pump. Reference to drawings of three of the sinterings, Figures 4-6, will reveal the range of tolerances produced. These are held especially close on squareness and center distance of holes.

Dimensions formed by the two opposing punches in the briquetting operation are the most difficult to maintain with close accuracy. Where these have had to be kept closer than normal commercial tolerances, the coining operation has been utilized.

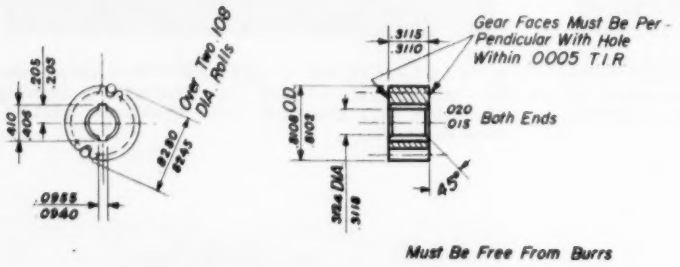
Despite the large number of close tolerances represented in this complete assembly built of sinterings, little machining other than the tapping of holes is required.

This use for iron sinterings ranging up to three inches in diameter, suggests many further applications. The amount of accurate detail that can be formed in an iron sintering will make this a more economical way to produce many small parts that are now being sand cast in iron and machined extensively. Further, the control of porosity which powder metallurgy permits, makes possible a self-lubricating or full density piece to meet service requirements.

***Michigan Powder composition MP 41.**

WITH THREE STEPS: pressing, sintering and coining, the close dimensional tolerances shown on drawings below can be achieved. Of particular important are flatness, squareness and center relationships of holes.

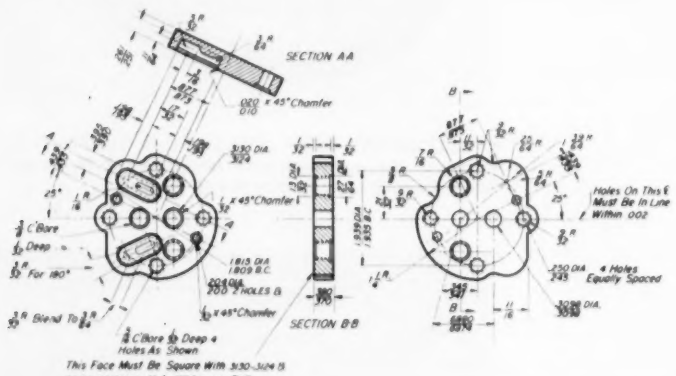
5. DRIVER GEAR



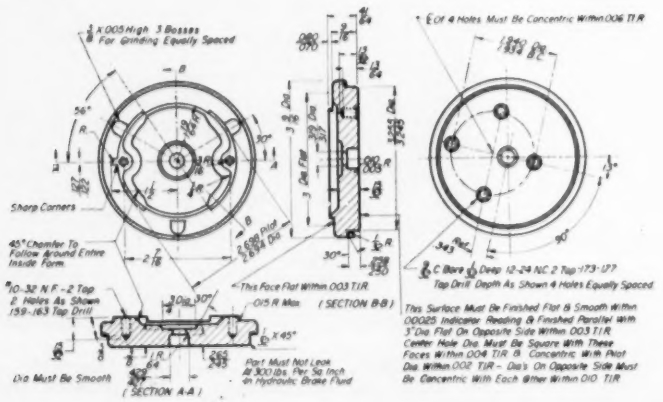
Gear Data
11 Teeth 16 D P. Involute
25° Pressure Angle
Pitch DIA. .6875
Addendum .0617
Dedendum .0764

Working Depth. .1234
Max. Root Fillet .036
Tooth Thickness .0979/.0960
Back Lash .0005 to .0045 When Two Like Gears Are in Mesh at .6875 Center Distance
Root DIA. .5348

6. PUMP HOUSING



7. END PLATE



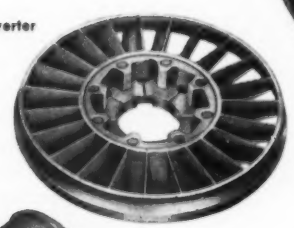
COSTS CUT – PERFORMANCE IMPROVED

WITH Thompson DIE and PERMANENT MOLD CASTINGS

Garbage Disposer Housing

Carbon Pile Regulator

Motor End Frame



Torque Converter

Air Connector

Steel-Belted Piston

OVER 25 YEARS OF EXPERIENCE gained in the exacting manufacture of precision automotive and aircraft parts is back of Thompson's die and permanent mold castings.

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Stronger, more durable parts that require less machining and finishing have dependable uniformity that eliminate costly scrap loss. And where finishing is required, Thompson's shop does the job better.

Whether it's an engine piston, a motor end frame, garbage disposer housing, carbon pile regulator, torque converter, launching barrel for a Bazooka, air connector or any one of many other parts, Thompson's creative engineers will gladly show you where and how you can simplify your operations with light metal castings and save on costs.

Write or call Light Metals Division, Thompson Products, Inc., 2269 Ashland Road, Cleveland 3, Ohio and a competent representative will call to help you plan new parts or re-design old ones.

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Metal Hydrides INCORPORATED

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Chrome-Nickel Alloy Powder

800 A Sup

Supplemental data on **Custom Alloy Powders** for **Alloy Steel Compositions*** ...high tensile strength

*50% Chromium—50% Nickel Alloy powder combined with 1% Graphite and electrolytic iron powder.

Tensile strength psi 121,000

(Sintered 2 hrs. at 1200°C.)

Sintered density	6.97
Elongation % in 1"	2.5
Rockwell Hardness	B-99

Multiple advantages accrue to you through the use of MH Chrome Nickel alloy powders for Alloy Steel compositions in your powder metallurgy molding —

- volume production of intricate parts, having higher tensile strength
- miniaturization of parts with greater strength and less mass
- no scrap or waste, no milling or finishing required

Fine particle size is an outstanding feature of MH Chrome Nickel alloy powders, as indicated on the chart below.

COMPARISON OF EFFECTS OF HEAT TREATMENT ON PROPERTIES OF ELECTROLYTIC IRON POWDER PLUS ALLOYS OF VARIED NICKEL—CHROMIUM CONTENTS

Compacting Pressure - 50 tsi.
Sintering Condition - 1100°C for 1 hour at temperature in hydrogen

MATERIAL	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Ni — 20% Cr) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G CC	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Cr — 20% Ni) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G CC
Sintered	72200	2.5	Ra83	7.11	66100	2.0	Ra99	6.64
Coined	76300	4.6	Ra85	7.18	63000	2.0	Ra95	6.65
Coined & Annealed	71000	3.5	Ra84	7.15	83000	2.0	Ra95	6.65
Coined & Quenched	76900	1.7	R-25	7.08	84400	2.0	Ra100	6.65
Coined, Quenched & Annealed	99500	0.5	R-15	7.08	92900	2.0	Ra96	6.65
Quenched	75800	2.1	R-19	7.11	84000	2.0	Ra97	6.65
Quenched & Annealed	88650	2.1	R-16	7.11	77300	2.0	Ra95	6.65

SIZE CHARACTERISTICS

(80% Ni — 20% Cr)		(80% Cr — 20% Ni)	
-100 + 200	2.4%	-100 + 200	4.7
-200 + 325	31.9%	-200 + 325	9.7
-325	285%	-325	85.6
	37.2%		

(50% Cr — 50% Ni)	
+100 mesh	0.8%
-100 + 150	4.5
-150 + 200	8.9
-200 + 270	11.0
-270 + 325	12.2
-325	62.6
Apparent Density g/cc By Scott Volumeter	1.89

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BASIC MATERIALS EXPOSITION TO BE HELD JUNE 15-19

An international exposition, said to be the first of its kind held anywhere, planned to meet the needs of industrial "worlds of tomorrow" by presenting under one roof the whole range of materials flowing from industrial laboratories, will take place in New York, June 15-19.

Called the "Exposition of Basic Materials for Industry, the show will occupy Grand Central Palace. Chairman of the board of sponsors which includes 20 major companies, is Don G. Mitchell, president of Sylvania Electric Products.

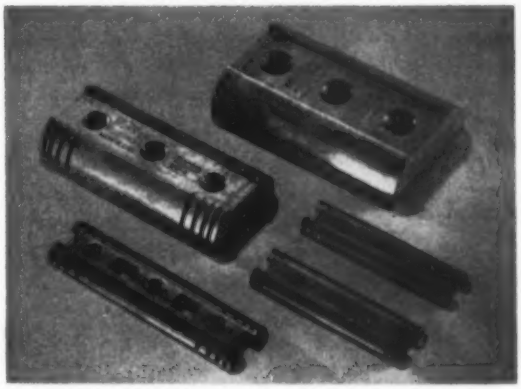
Simultaneously with the convention, a series of technical conferences will be conducted to discuss the properties and potentialities of new materials. The event is intended to create a new source of information and ideas for engineers, researchers and executives. Attendance is expected to reach 15,000.

Besides the emphasis on new materials, the exposition will demonstrate new uses for standard products, such as wood, metals, alloys, plastics, ceramics, textiles, leather, rubber, cork and glass. Product components and accessories will be featured.

Both the exposition and conference will cut across industry lines to introduce the new products to the hundred different types of manufacturers in business today.

Serving with Mr. Mitchell on the board of sponsors will be John R. Hoover, president, B. F Goodrich Chemical Co.; R. S. Reynolds, Jr., president, Reynolds Metal Co.; Eugene C. Sullivan, honorary chairman of the Board, Corning Glass Works; M. J. Donachie, president, Beryllium Corp.; Austin R. Zender, vice-president, Bridgeport Brass Co.; Lawrence Ottinger, president, U. S. Plywood Corp.; Milton P.

continued on page 94



GOOD WEAR RESISTANCE and casting qualities make aluminum bronze the preferred material for the smaller hone shoes. Cast by the plaster mold process, the shoes are used in the as-cast condition. Where greater wear is allowable in the larger shoes, zinc die castings are used.

WEAR-RESISTANCE COMBINED WITH SOFTNESS in bronze plaster mold castings

By WALTER SPEISER*

ONE of the products of the Sunnen Products Company of St. Louis, Mo., is a line of internal honing tools used with Sunnen honing machines. Basically, these tools consist of steel mandrel bodies in which the abrasive stones that do the actual honing are mounted, together with an expanding mechanism. Opposite these abrasive stones are metal shoes which guide the work being honed. The guide shoes must have good wear-resistance, yet must be relatively soft so that they will not scratch the metal being honed.

On hones below ¾" diameter, physical restrictions make it necessary to have the guide shoes as an integral part of the hone. Above this diameter, shoes are replaceable. On the smaller sizes of replaceable shoes, the problem of what metal to use is especially acute because of the small allowable wear.

The most practical material thus far developed for this application is an aluminum bronze containing 10-11 percent aluminum, 3-4 percent iron and the balance copper (maximum of all other metals 0.6 percent). It has excellent wear characteristics and, in the as-cast condition, a hardness of 90 Rockwell B (183 Brinell).

One of the outstanding features of this alloy is its excellent casting quality. Because good detail as-cast is required, and in order to obtain a shoe requiring the least possible amount of machining, all of the bronze shoes are plaster-mold cast

While extreme accuracy is the keynote of honing operation, the design of the shoe is such that the normal tolerances obtainable by the plaster mold casting process are adequate. After removal of gates and risers, the only surface finishing needed is barrel tumbling to remove casting burrs; additional operations consist of broaching the rectangular locating holes and sizing of the small locating pads.

Most of the hones are used in through holes. In this application, experience has shown that the shoes tend to wear less on the ends than in the center. To compensate for this unequal wear, grooves are milled into each end of the shoes. Several of these finished shoes are shown.

For those applications where a blind hole is to be honed, the wear along the shoes is quite uniform so that grooves are not needed in the ends of the shoes. Because of the need for the two styles, all shoes are cast without grooves and where needed, the grooves are milled after they are received from the foundry.

Earlier, mention was made that the smaller diameter shoes have very little allowance for wear. On the larger hones, however, more space is available for the guide shoe wear surfaces. Zinc die castings therefore are used, because they are less expensive. Two sizes of the die cast shoes are shown.

*Honing Engineer, Sunnen Products Company, St. Louis, Missouri

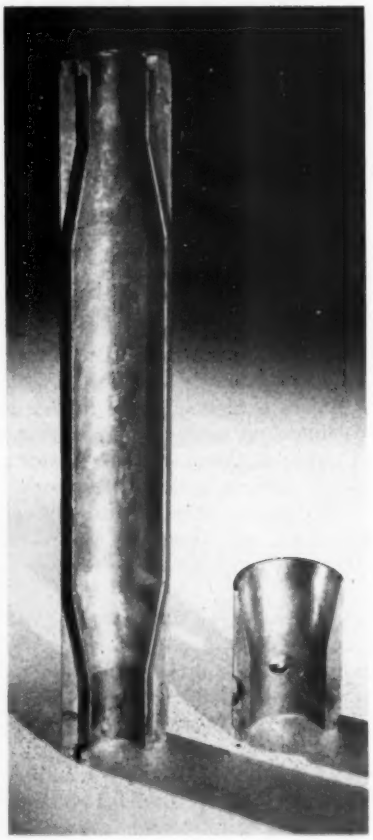
A search for proper heat transfer is the story behind the unorthodox progression from aluminum bar stock to plastic bonded paper lamination to an aluminum die casting in the design of this cable vulcanizing equipment.

It is an unusual story because of the special heat transfer and corrosion resistance characteristics needed for vulcanizing rubber-covered cable.

ALUMINUM DIE CASTING replaces laminated plastic-bonded paper

WHEN rubber covered cable and rubber insulated cable must be either repaired or spliced, it is essential for a good job that the insulation or the covering, or both, be replaced with rubber and that it be vulcanized in place to give a safe and serviceable job.

Equipment to do this vulcanizing work is made by the Joy Manufacturing Co. of Pittsburgh, Pa. Made in portable types, all of the vulcanizing units up to those capable of handling two-inch diameter cable use aluminum mold shoes. This use of aluminum mold is, of course, similar to the well-known cast tire manufacturers.



Two types of molds are shown above. The longer one handles cable that is 15/16 diameter and gives a finished splice 1-9/16 diameter while the shorter one is for 1-3/8 cable with a 2 inch diameter splice.

As originally designed, these mold parts were machined from square aluminum bar stock. Later the material was changed to a plastic bonded paper lamination and finally to die castings. Functionally, the aluminum is superior to other materials due to its high thermal conductivity and, where a moderately great mass is used, aluminum molds give a more uniform heat distribution than most other materials.

Functionally, it has been found, that there is no comparison between a metal and a non-metal mold for this application. If then a metal mold is to be used, a choice must be made of both material and method of fabrication. Economically, an aluminum die casting has all of the inherent advantages of aluminum plus the advantages of the die casting manufacturing process.

The molds made as die castings are ready for installation in the machines after drilling

continued on page 73

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speedier and more economically

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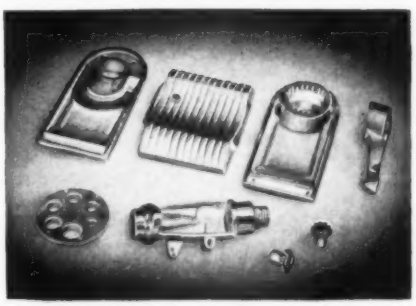
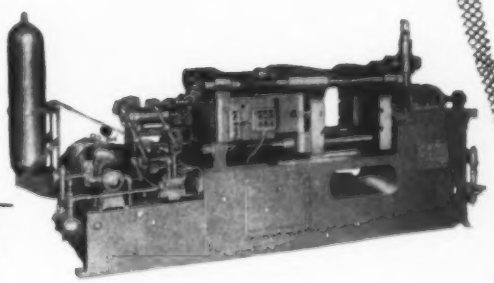


DIE CASTING MACHINES!

In designing their new Dexter model, the Automatic Pencil Sharpener Company considered appearance, performance and production of equal importance. To assure results as outstanding as the deluxe new Dexter has proved to be, Automatic chose KUX die casting equipment.

The exacting specifications demanded for superior die castings of the sharpener's base and uprights as well as internal mechanical parts, handle, and centering disc—a total of eight die castings—made the selection of KUX a natural one. Substantial economies of production resulting from the use of KUX machines offered further advantages.

Why not give your product the benefit of such economies and improved die casting techniques?



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Hydraulically operated die casting Machine for production of lead, tin and zinc castings up to 10 pounds.

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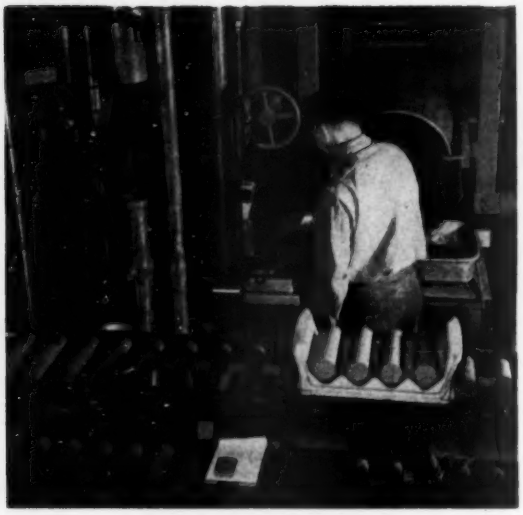


1. First operation — in transforming powdered metal into anti-tank cores of solid tungsten carbide. After carefully weighing out the proper amount of metal powder, the press operator pours it into the mold at his left. The press then compacts the powder under 60 tons pressure for 13 seconds. Freshly compacted soft cores can be seen in the foreground.

2. First conveyor ride for the cores begins near the molding machines when they are placed on padded plastic trays that carry them to the pre-sintering furnaces in background. Near the furnaces, trays are emptied and cores placed into graphite containers or "boats". Worker is covering the cores with asbestos powder for the 10-hour trip through the furnace.

NOW IT CAN BE TOLD—

How powder metallurgy produces solid tungsten-carbide anti-tank shell cores

IN answer to an Army commander's urgent request for a tank buster to stop the German Tiger tanks in 1944, production of solid tungsten carbide anti-tank shell cores was started by Carboloy*. It has been resumed since the start of the Korean conflict and has been placed on a semi-mechanized basis, except for inspection and testing.

Because of the unusual interest in this unique product of the powder metallurgy process, the editors of PMM present here a series of photos showing how these cores are produced. The information, until recently classified as a military secret, has now been released for publication.

The solid tungsten carbide core, which is today produced both in four and eight-pound versions, for 76 and 90 mm carriers respectively, was originally developed by Carboloy in two days during the "hotter" days of World War II. In less than two weeks it was test fired at Aberdeen Proving Grounds and enroute in quantities by plane to Europe.

Mechanization has since been introduced, along with modern materials handling, heat treating, machining, inspection and testing. On these pages are presented the start-to-finish story of the production of solid tungsten carbide anti-tank shell cores.

*Now a Department of General Electric Company.

3. Pre-sintering is done in two stages. In the first, the pressing lubricant, paraffin, included in the metal powder for core production, is burned out; in the second, cores are hardened just enough so they can be handled without damage, and soft enough to be ground on an ordinary silicon grinding wheel. View here shows the nose operation of forming of the ogive. Work is done with a grinding wheel formed to a special shape to provide a bullet-shaped nose. This grinding operation also adjusts the core to its proper length.

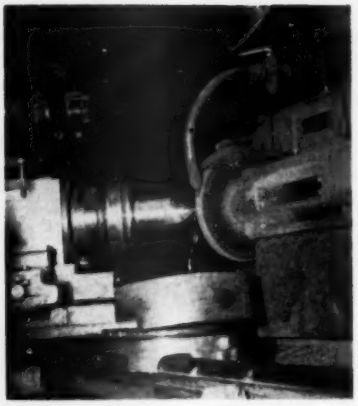
4. Following inspection, the cores again travel via tray and conveyor to the final sintering furnaces. Here, they are again placed in graphite "boats" and covered with Alundum powder. In less than eight hours after entering the sintering furnaces the cores emerge — somewhat shrunken (about 18 per cent) but almost diamond-like in hardness. Furnace man here is charging a "boat-load" of cores in the furnace. Hydrogen is used for heat treating.

5. On leaving the sintering furnaces, the cores cool in the graphite "boats" while on the conveyors leading to the next inspection station. There they are given a wet-dry weight test and checked for length and runout. Inspector is shown checking a core for length while a core is automatically being checked on the run-out stand.

6. The break test — but no cores are broken here. Before going on to final machining the tungsten carbide cores also go through a rupture testing station where they are preloaded under 40 tons pressure. Worker here has just placed a core in position for the 80,000-pound test and is closing the steel safety door.

continued next page

7. On the final machining line, the cores are first rough, then finish ground by a pair of centerless grinders. This view shows the cores emerging from the rough grinding operation and heading for finish grinding. Worker pushes each core through — nose first — with a long pole.



8. Those cores needing slight adjustments on the nose or base are grouped according to the work that must be done on them and passed along, also by conveyor, to the machine required for the work. In this view a diamond grinding wheel is being used to adjust the ogive. At this stage cores have an average Rockwell hardness of 83 A.

9. This view shows the cores, nine at a time and bases up, go through this grinding operation. A diamond wheel is used here also, and the bases are swung back and forth under the wheel.

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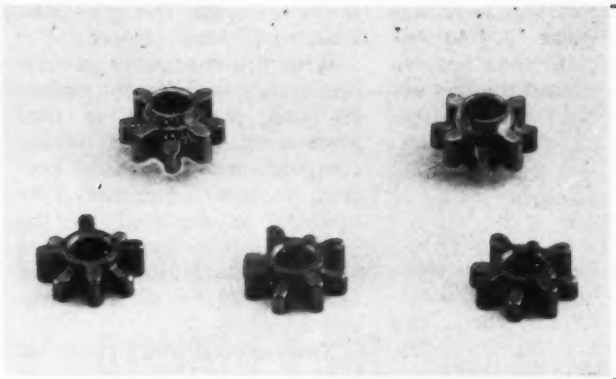
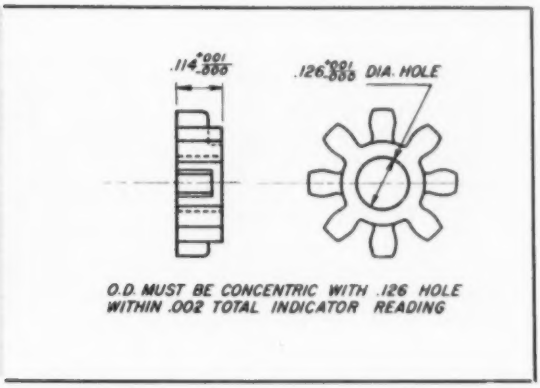


1. ONE IMPORTANT CHANGE in design was indicated when extruded pinions, rear, were redesigned for powder metallurgy, foreground. The shank which was needed to give greater bearing surface on the extruded pinion, has been dispensed with on the sintered pinion because of greater accuracy of hole size.



2. THICKNESS and hole diameter must be held very close so that proper gear meshing is accomplished. Tolerances being held on a production basis are indicated above. Barrel finish removes burrs.

TINY SINTERED PINIONS – a comparison with extruded brass

By ROBERT J. VISIN*

THE millions of small pinions that go into instruments and machines each year are produced by many different methods. extrusion, casting, stamping, machining, molding or cutting from wire. Materials in which they are shaped includea wide range of ferrous and non-ferrous metals, from the tough impact-resisting alloys to the soft, dimensionally-stable tin base alloys.

The conditions of service and specific cost factors will determine, in each instance, the choice of material and fabricating method.

We have gained a great deal of experience in the design and choice of materials for pinions, since they are among the most important, and certainly, the most numerous components in the thousands of industrial counters we manufacture.

One of the new and promising methods of producing small pinions is the powder metallurgy technique. Sintered iron or brass pinions that we are using compare favorably in cost and service with extruded pinions that they replace, especially for non-standard shapes such as those shown in Figures 1 and 2, having alternate teeth "mutilated".

In-plant operations compared

One particular in which sintered pinions have proved to have a genuine advantage over the previous pinions that were cut from extruded stock, is the saving of in-plant operations.

For example, the machined pinion was cut off, then turned to form the shank, and finally the alternate teeth were "mutilated" with an end mill. A pronounced burr that was left was wire brushed, which

continued next page

*Assistant to the President, Production Instrument Co., Chicago, Ill.

meant handling and finishing each individual pinion.

Sintered pinions are received with all dimensions completely finished. The shaft hole and teeth are formed to final dimensions in the pressing operation and require neither coining nor machining.

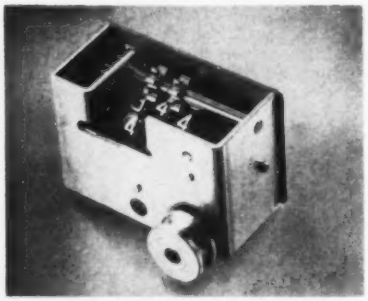
The slight burr remaining can be removed by bulk finishing methods, saving individual handling. They are barrel deburred by the Roto-Finish method. The machined pinions had such a large burr that tumbling tended to fold the burr over, rather than remove it, but the sintered pinions are barrel finished quite effectively.

Pinion materials compared

The extruded pinions were produced in brass, which is satisfactory for extrusion and mates well with a molded plastic gear without abrading the softer material. The gear is an 8-tooth, 28 pitch pinion.

With the change to powder metallurgy, a different material was chosen. It is now pressed in a powder having composition of iron — 99 percent, carbon 1 percent. This material is reported by the fabricator, Chicago Powdered Metal Products Co., to have tensile of 29,000 psi and density 5.8 g/cc.

The sintered iron pinion has better wear characteristics than the brass extrusion and also mates well with the plastic gear. The sintered pinions have been tested for 120,000,000 cycles with absolutely no measurable wear. The test is being continued although the life already proves to be many times the normal requirements.



3. POLISHED SHAFTING has been introduced because hole diameter of sintered pinions is so uniform that high quality fit can be obtained. This was not feasible previously due to variations in machined center hole.

Design factors and tolerances

Two changes in design detail were called for by the change from an extrusion to a sintering. The more important of these can be seen in Figures 1 and 3.

The extrusion was machined to have a sizeable hub in order to prevent wobble on the shaft. The fit of the pinions on their shaft is quite critical because wobbling or binding would result from improper fit.

continued on page 75

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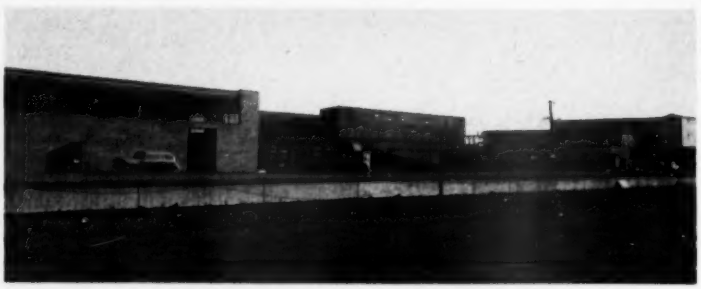

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They said this shaft couldn't be made at a practical cost

This small cam shaft was precision cast for Union Switch & Signal-Division of Westinghouse Air Brake Company. It is used in the control panel of the "Union" Retarder Speed Control and Automatic Switching — a system that controls freight car routing and speeds in the freight yard.

The lever and lever supports for the control panel were also precision cast and then chrome plated to improve appearance.

... but, Inco Precision Investment Casting proved it could be done

The Union Switch & Signal-Division of Westinghouse Air Brake Co., had designed a new control system for railroad yards. The system made it possible for one man to control the sorting and braking of all cars in the yard.

But one small part almost threw a wrench in the works.

It was a small cam shaft for the control panel of the unit.

To make it by machining just wouldn't be practical.

As small as this shaft is, it would require as many as six turning operations, six milling operations and lapping — plus the fact that more than half the 1-inch bar stock would be machined away into waste.

It was just too expensive an undertaking in both time and materials.

That's when the engineers of the Union Switch & Signal-Division called on Inco Precision Investment Casting specialists.

Our specialists precision cast the cam shaft — from 1050 steel — to tolerances of plus or minus .005" per linear inch. All that was needed afterwards was a little lapping of critical surfaces and a slight straightening of the shaft.

The engineers were more than pleased with the results. In fact, they even redesigned other parts in the equipment for precision casting. Those parts were cast of 1017 steel and chrome plated to improve appearance.

This is one of many examples of how precision castings can cut production costs and at the same time open up greater design possibilities.

In some instances precision castings save as much as 60 percent of production costs...Reduce machine shop bottle necks. Make possible the use of extremely hard metals. Frequently lead to economies through re-design. Reduce metal scrap. Often permit the use of a higher alloy which otherwise would be too costly.

Whenever you have a part which is 6" x 5" or smaller, weighs under 3 lbs., requires tolerances as close as plus or minus .005" per linear inch, and needs 5 or more fabrication steps, there is a good chance you can cut costs by having it precision cast.

For more information, write for a free copy of "Investment Casting — Its Advantages and Practical Applications." The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

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For additional information Circle No. 11 on the Reader Service Card

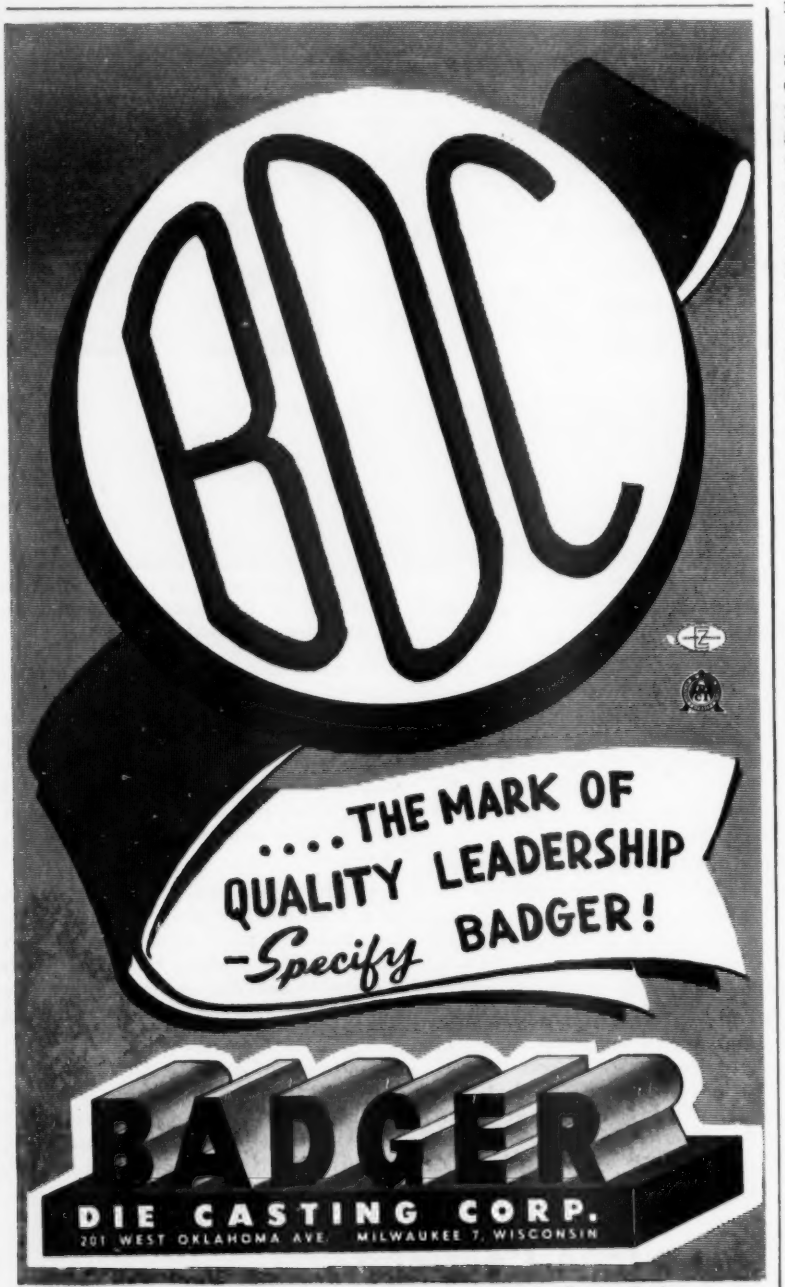
TO STUDY OXIDE FILMS FOR METAL PROTECTION

A $5,000 grant for aid in the study of oxide film, with a view to growing protective films on metals, has been made by Research Corporation to Stevens Institute of Technology, Hoboken, N. J., the Institute has announced. The gift is called the Harvey Nathaniel Davis Grant in honor of the late president of Stevens.

Robert B. Green, associate professor of physics, who is in charge of the project, described it as the first attempt to use the electron microscope and electron diffraction simultaneously to study the growth and structure of oxide films. The eventual objective of the work is to develop methods of producing oxide films that will protect metals from corrosion.

Pure aluminum and nickel form self-protecting oxides naturally, Dr. Green noted, but other metals, notably the iron group, are not protected by their oxides and continue to corrode indefinitely. If oxidation could be arrested near the surface in iron and steel, Dr. Green pointed out, much waste in industry due to corrosion could be averted.

Zinc and aluminum will be studied first, with the prospect of studying iron when techniques are perfected. Aspects studied will include discontinuities, cracks, wrinkles, and the location of these features in relation to the original surface. Fresh surfaces will be produced both by the fracture of single and polycrystalline specimens, and by cleaning of surfaces that have not been subject to plastic flow. Dr. Green proposes to grow single crystals of aluminum and zinc, in order to study the effect of crystal orientation.



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TUNGSTEN—ITS METALLURGY, PROPERTIES AND APPLICATIONS; Colin J. Smithells; The Chemical Publishing Co.; $8.50.

The introductory part of this comprehensive book gives an outline of the mineralogy of tungsten. The treatise then advances to cover step-by-step treatment for the production of metallic tungsten, the working of tungsten to obtain various ductile products, the metallographic structure of the pure metal and the influence of manufacturing operations on physical properties.

It also covers the most important tungsten alloys and their industrial applications, chemical and spectrographic methods for the determination of impurities and other related topics. The book contains 225 illustrations.

PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating, or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

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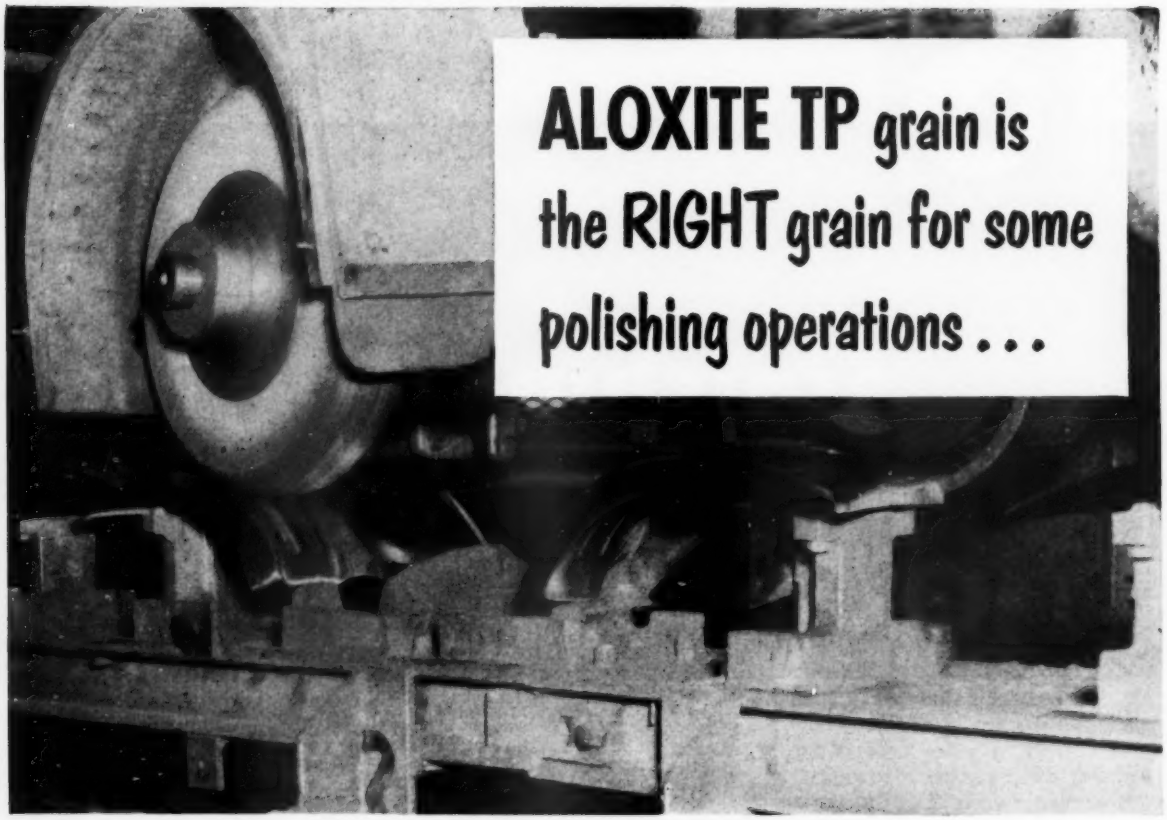

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ALOXITE TPC Aluminum Oxide	Medium sharp. Grits 16 through 220.	General purpose polishing grain—for removal of small amounts of metal.
ALOXITE TPW Aluminum Oxide	Powder. Grits 240 through 1000.	As the abrasive in paste heading of polishing wheels and belts.
CARBORUNDUM RA Silicon Carbide	Sharp, very friable. Grits 10 through 240.	Polishing cast iron.
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Pointers on plating chromium over ALUMINUM DIE CASTINGS

By CLARENCE FORESTEK*

THE principal reason why most commercial plating establishments are reluctant to chromium plate aluminum die castings is their desire to avoid using hydrofluoric acid in preparing the castings for plating.

*Forestek Plating Co., Cleveland, Ohio.

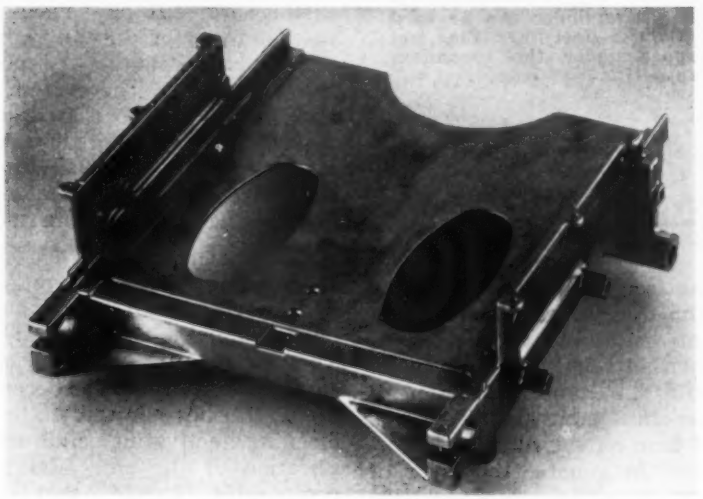
The actual procedure for plating aluminum is widely known and does not present any particularly difficult problems, particularly when only a decorative surface is needed.

When the chromium plate is to be hard or industrial chrome with thicknesses ranging from several thousandths of an inch to thirty or more thousandths some other problems enter that make the process more difficult.

The factor that differentiates die cast parts from others such as extrustions or forgings is the presence of either silicon, copper or magnesium in relatively large amounts, particularly since a homogeneous mixture of these alloys is seldom achieved. These alloying elements, individually or in combination, leave a "smut" on the casting surface after cleaning and activation. Since this "smut" is very adherent and largely silicon dioxide, hydrofluoric acid is apparently the only practicable method of removal.

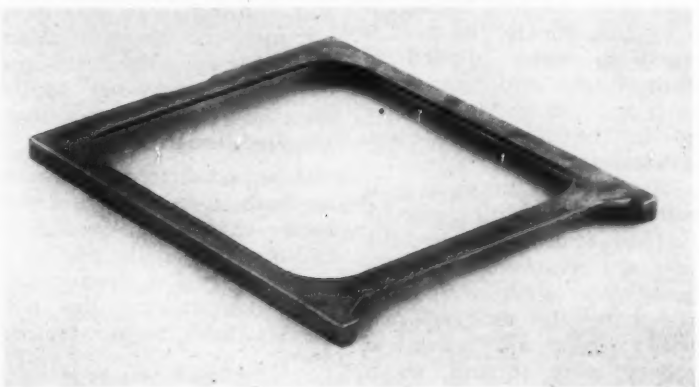
In the work done at Forestek Plating and Mfg. Co., the formation of undesirable surface deposits during the cleaning and activation portion of the cycle is largely overcome by shortening the cleaning cycle enough so that smut formation is avoided. A sufficiently clean surface can be secured to alloy deposition of a thin film of zinc by using a very brief cleaning cycle provided that the original surface of the casting was sufficiently good so that this short cycle is applicable.

The point of a good surface for finishing is one that cannot be over-emphasized. In the die casting of zinc, the so-called hardware finish has been developed for those parts that are to receive a decorative plating. This finish often allows direct plating after only a mild cleaning operation.



Dull nickel electrodeposited over copper on an aluminum die casting that has been given a flash coat of zinc. The part is the base of the developing frame for X-ray Polaroid film.

Die cast in aluminum for light weight and economy, hard chromium electroplated for wear resistance. No zinc flash or copper plate is used under the chromium.



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Once the zinc flash is applied, any normal electrodeposited finish is possible. Here the bar is chromium plated, the tube cadmium plated and the hook barrel nickel plated.

By hard chromium plating the cylinder walls, an aluminum die cast cylinder can be used without a steel liner. Zinc and copper under the chromium can not be used here.

Little if any polishing or buffing is required and the surface of the casting is not disturbed. With aluminum, on the other hand, no such finish has been widely developed. As a result, a considerable amount of work must usually be done before going into the cleaning bath and in some cases stain and other surface imperfections are of sufficient magnitude to require an objectionably long cleaning cycle.

Assuming that a good cleaning operation is carried out with no smut formation, the balance of the plating operation is relatively simple.

The initial step after cleaning and activation, generally in dilute nitric acid, is to deposit a thin film of zinc on the metal surface. This deposition is possible by virtue of the relative positions of aluminum and zinc in the electromotive series of metals.

If aluminum is immersed in an alkaline solution of sodium zincate, the first action is for the free alkali to dissolve the film of aluminum oxide present on the metal. The caustic then attacks the base metal with simultaneous solution of the aluminum and deposition of zinc on the aluminum surface. In general the layer of zinc deposited is thin and very adherent. Both the thickness and the character of the zinc film can be varied by both time and temperature and the particular alloy being handled will govern both.

In some cases, a double zinc dip is desirable. For these cases after the first treatment in sodium zincate, the part is rinsed in water, dipped in dilute nitric acid, rinsed in water and followed by another dip in the alkaline sodium zincate solution.

The zincate solution, as generally used, is quite viscous and tends to drag out when the parts are removed. Normally a cold water wash is adequate to remove the dragged material except in narrow grooves, slots, threads, small holes, etc. Where such spots exist that might trap the zincate solution, further washing using a jet of cold water is advisable.

Properly done, the aluminum die casting will, at this stage, be completely coated with a tight, thin layer of zinc. Further, plating with copper, nickel and chromium can then proceed as though the piece were a zinc die casting except that chemical attack of the thin zinc film should be avoided. Barrel and bulk processing and plating are easily performed with similar processing techniques.

Adequate methods of chromium plating aluminum die casting are still new enough so that tests for durability in various atmospheres are not fully evaluated. There seems, however, to be no reason to believe that there will be any marked difference between the service life of a chromium plated zinc or aluminum die casting.

Earlier, mention was made of applying hard chromium onto aluminum die castings. The procedure here varies somewhat from that for decorative finishes. Initially, the cleaning, activating and application of the zinc film is comparable except that a much thinner layer of zinc is desirable.

At the start of the plating operations, however, the major difference is noted. Neither copper or nickel should be applied under the chromium and for the best results, the zinc should be removed prior to application of the chromium. Through suitable techniques chromium can be applied directly to aluminum without the zinc undercoat.

A second difference is found in bath temperatures. Most hard chromium procedures call for starting the plating at a relatively low temperature and then raising the bath quickly to a higher temper-

continued next page

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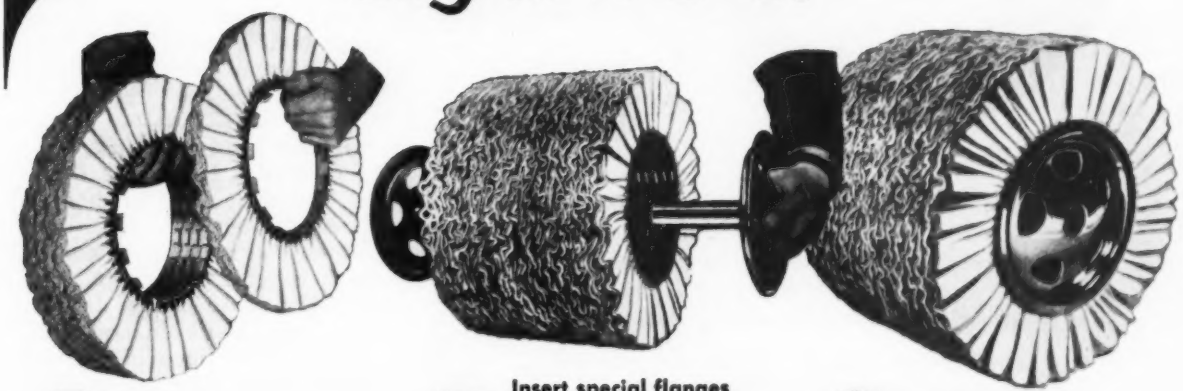

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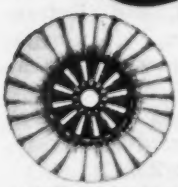

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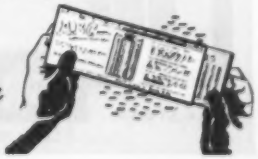

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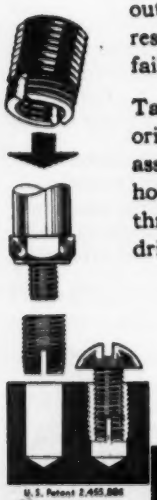
The Tap-Lok Insert withstands vibration without loosening and has maximum torque-and-pull resistance. It is not subject to the time-wasting failures of cast and molded inserts.

Tap-Lok Inserts are used in large volume as original equipment on regular production line assembly. In addition, they save many man-hours in salvage work for repairing stripped threads. They are easily inserted with a simple driving tool as shown in the drawings to the left.



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*Reg. U. S. Pat. Off.

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ature. With the very large difference that exists in expansion properties between aluminum and chromium, this procedure tends to set up excessively high strains in the plated layer which often result in cracking and lessening of adhesion. Utilization of a single temperature for the entire plating operation minimizes this effect. Patent protection has been granted for the above hard chrome plating method.

Both decorative and hard chromium plating are regularly done on a production schedule and any other plated surface can be applied to aluminum die castings provided an adequate zinc surface film is first applied. Brass, cadmium, silver, lead and others have been successfully applied.

EDWARD S. BASSETT DIES

Edward S. Bassett, 83, former president and director of Cowles Chemical Co., died March 9 at his home in Cleveland Heights, Ohio. Mr. Bassett was born in New Haven, Conn. and had been associated with Cowles since 1918 when he became a director. In 1926 he was appointed general manager, and in 1930 was elected president, serving in that office until 1938. At that time he became chairman of the board and served until 1941 when he retired from that office but retained his membership on the Board and continued to serve the company as secretary.

NORTON MOVES N. Y. SALES

The New York City domestic sales offices of the Abrasive Division, Grinding Machine Division, and Refractories Division of Norton Company, Worcester, Mass., formerly of 61 Broadway, have moved to Green and North Street, Teterboro, New Jersey, effective March 23.

The office of Norton Behr-Manning Overseas Inc., will remain at 61 Broadway, New York 6, New York.

PROMOTIONS and APPOINTMENTS

Three promotions announced by *Buffalo Electro-Chemical Co., Inc.* include G. G. CREWSON, director of engineering; J. N. VERMILYA, chief engineer; and CHARLES M. STANDART, assistant to the chief engineer.

BERT HAWHEE has been appointed as sales representative by *Wagner Brothers, Inc.* of Detroit, Mich.

Announcement of the appointment of RAY E. GREINER as director of purchases has been made by the *Speer Carbon Co.*, of St. Marys, Pa. Mr. Greiner was formerly purchasing agent for the company's International Graphite and Electrode Division.

The recent election of P. H. RICHEY as assistant treasurer and F. J. CHIELNICKI as assistant secretary has just been announced by the *Detrex Corp.* of Detroit, Mich.

The *Claud S. Gordon Co.* of Chicago, Ill. has appointed CLAUDE A. GATES as representative in the New York City area.

The new field engineer for the southeastern New York territory of *The Bellows Co.*, of Akron, Ohio will be FREDERIC C. PERRON.

The Hydraulic Press Mfg. Co., of Mount Gilead, O. has announced the promotion of WILLIAM H. BENNETT to director of engineering.

The appointment of HAROLD W. LOWNIE, JR. to a supervisory post at the *Battelle Memorial Institute* has been announced. He will supervise research in foundry practice and ore reduction.

DR. KENNETH C. VINCENT has been appointed supervisor of extraction metallurgy at *Armour Research Foundation.*

The Metals and Ceramics Div. of *P. R. Mallory Co.* announces the promotion of GEORGE S. BOND to sales manager. Previously Bond was chief engineer of the same division.

JOHN B. MERRILL has been appointed to the new post of vice president in charge of metallurgical and chemical operations of *Sylvania Electric Products, Inc.*

HENRY F. ARNDT has been named chief engineer, *Detroit Electric Furnace Div., Kuhlman Electric Co.*

DR. PETER P. ALEXANDER has been elected chairman of the board of directors, and LOUIS W. DAVIS, president and general manager, of *Metal Hydrides, Inc.*

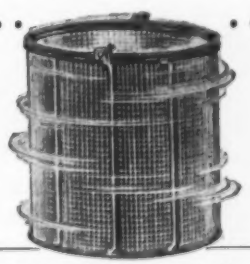
JEROME J. THEOBALD of Skaneateles, N. Y., has been appointed sales representative for *Gries Reproducer Corp.* in New York State outside metropolitan New York City.

DRIES SMALL PARTS *Faster–Better...*

DOES IT FOR LESS!

Kreider Dryer with auxiliary gas heating unit (illustrated). Auxiliary steam heating unit available; also standard model without auxiliary heating.

Basket (shown below). Heavy gauge steel woven mesh over steel frame. Capacity, 1140 cu. ins.



Spin-Dries* up to 50 pounds in less than 2 minutes

Simple design . . . careful engineering, sturdy construction assure trouble-free, low-cost maintenance operation. Operates at 625 r.p.m. on less than 1 h.p.

No scarring or marring . . . with Kreider Dryer. Centrifugal force holds parts immovable in basket . . . assures smooth, evenly dried surfaces, long-lasting luster, minimum "rejects".

One man runs it! Standard model Kreider Dryer occupies less than 6 sq. ft. floor space. One man tends—loads, unloads—keeps production moving, prevents expensive, time-wasting tie-ups.

See for yourself! Write Dept. PR-533 today for illustrated 4-page folder . . . also addresses of installations near you.

New Holland Machine Co., New Holland, Pa.

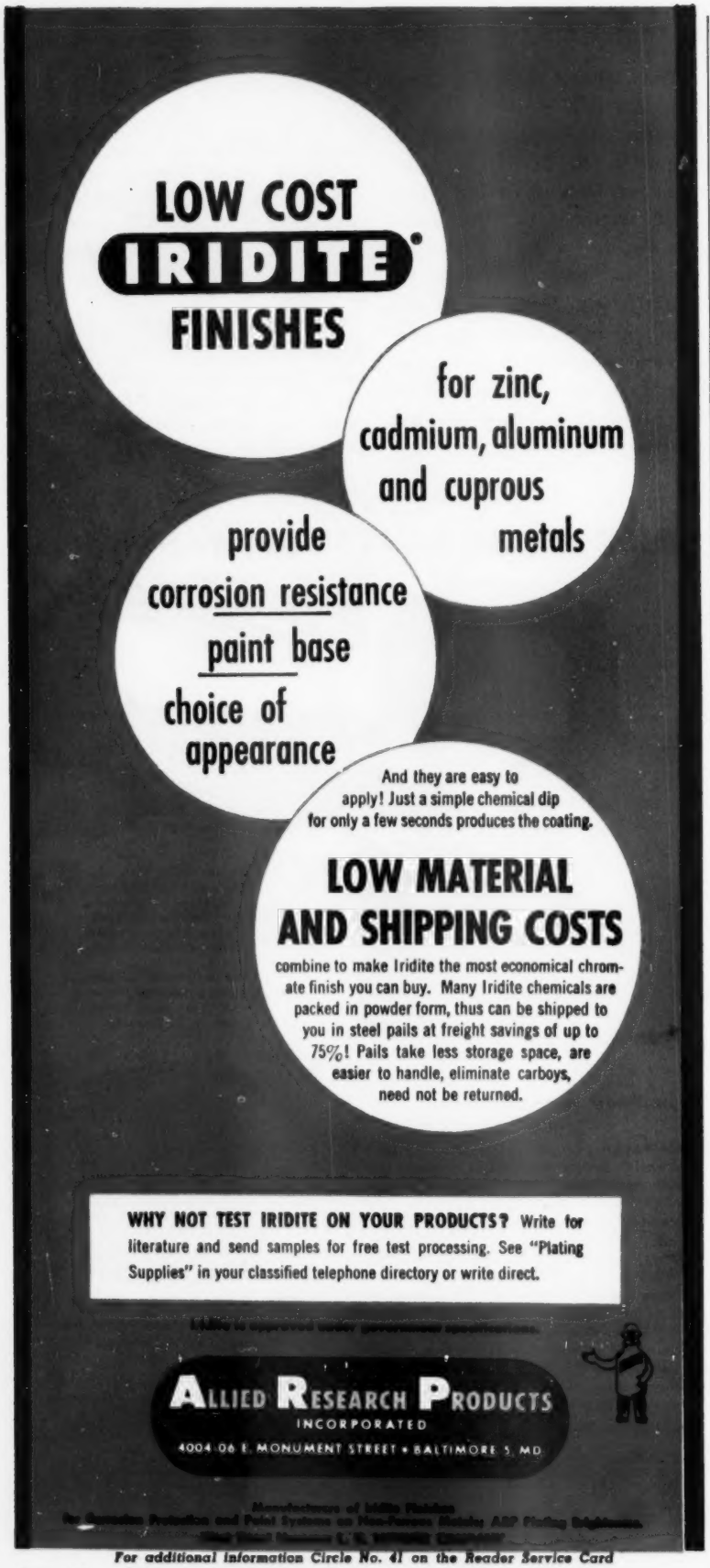
***Only 2 simple steps required . . .**

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON."

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

NEW HOLLAND *KREIDER* DRYER

For additional information Circle No. 62 on the Reader Service Card


LOW COST
IRIDITE
FINISHES
for zinc, cadmium, aluminum and cuprous metals
provide corrosion resistance
paint base
choice of appearance
And they are easy to apply! Just a simple chemical dip for only a few seconds produces the coating.
LOW MATERIAL AND SHIPPING COSTS
combine to make Iridite the most economical chromate finish you can buy. Many Iridite chemicals are packed in powder form, thus can be shipped to you in steel pails at freight savings of up to 75%! Pails take less storage space, are easier to handle, eliminate carboys, need not be returned.
WHY NOT TEST IRIDITE ON YOUR PRODUCTS? Write for literature and send samples for free test processing. See "Plating Supplies" in your classified telephone directory or write direct.
ALLIED RESEARCH PRODUCTS
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For additional information Circle No. 41 on the Reader Service Card

CHROMIUM PLATING WITHOUT NICKEL

Reports of a process for chromium plating over zinc die castings without a nickel undercoating has been reported by Marmet Ltd., British manufacturers of Letchworth, England. According to Target, a publication of the British Central Office of Information, the basis for the process is sodium tetrachromate formed by the reaction of two molecules of caustic soda and four molecules of chromic acid. Sodium tetrachromate is a low temperature chemical needing a much cooler temperature than standard chromium plating.

The best results have been obtained by using chromic acid (53 oz. to the gallon), caustic soda (7.70 oz. to the gallon), trivalent (1 oz. to the gallon) and sulphuric acid (0.10 oz. to the gallon). The chrome tank is about half filled with water in which the chromic acid is dissolved. The caustic soda is dissolved in a separate tank, and when cool is slowly added to the main tank. The sulphuric acid is also added slowly with constant stirring. The advantages claimed for the process are a reduction in labor costs; corrosion resistance is claimed to be superior to normal chrome on equivalent thickness and the rate of plating from 10 to 50 times faster.

One admitted disadvantage is the dullish grey finish obtained, but it can easily be polished to a lustre approaching normal bright chrome.

NORTON EXPANDS

Norton Company of Worcester, Mass. took the wraps off the new $6,000,000 expansion of its Grinding Machine Division March 31 when editors of newspapers and technical magazines toured the plant, the first group to visit the new structure since it was completed. Shown publicly

for the first time, this plant provides about 50 percent increase in capacity for the production of Norton's complete line of 45 different types of precision grinding and lapping machines.

The new plant, built to meet the demands of the present defense effort, consists of a 740 by 300-foot factory joining a 360 by 100-foot office building.

ELECTROPLATERS MEET IN PHILADELPHIA JUNE 15-18

The 40th annual convention of the American Electroplaters' Society will be held on June 15-18 in Philadelphia. The technical sessions will cover a wide variety of subjects and are high-lighted by a symposium on chromium plating. Papers to be presented have been carefully selected to cover all phases of plating including cost estimating, the control and effect of cyanide decomposition, recent developments in the plating field, test procedures, etc.

A special round table question period will be conducted on the evening of the 16th. All speakers will be present but it is anticipated that the major portion of the discussion will be from the floor.

STUDY PROTECTIVE COATINGS FOR LOW ALLOY STEELS

A Wright Air Development Center research contract for developing better high-temperature corrosion and oxidation resistance in low alloy steels has been awarded to Sam Tour & Co., Inc., a New York City technical consulting firm. The project will explore processes for depositing protective surface coatings on steel. The results should ultimately enable industry to reduce the amount of nickel and other critical metals now required in engines and other aircraft components.

Backstand Belts cut finishing time 70%

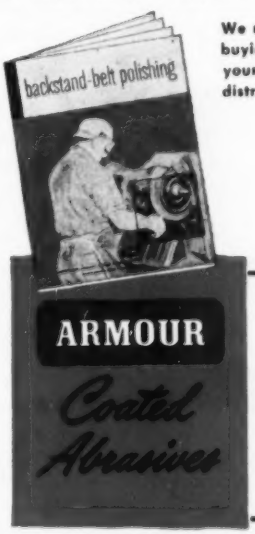
5 minutes on a set-up wheel cut to 1½ minutes with Armour Backstand Belts

Changing from set-up wheels to backstand belts saved 3 minutes 39 seconds in finishing forged paving breaker handles, reports a well-known company*. This operation formerly took 5 minutes 11 seconds. And this wasn't the only saving. Backstand belts outlast 4 to 5 set-up wheels; without dressing they remain flat and true. And due to their uniform grit, they give a better finish.

Belts are only one of the many forms of Armour coated abrasives. There are more than 30,000 different varieties in grit size, backing, etc. We have sheets, disc, rolls, tubes—and specialties to meet your specifications. Your industrial supply distributor will tell you about the Armour line. Call him today!

The complete story of the money-saving backstand belt method is covered in our free booklet offered below. Send the coupon for your copy now!

*Name of company available on request



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MAIL THIS COUPON TODAY!

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Please send me your free booklet, "Backstand Belt Polishing."

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For additional information Circle No. 43 on the Reader Service Card

TUMBLE FINISH

Come to GRAV-I-FLO for ALL your tumbling needs!

You can get complete equipment and supplies for faster, better tumbling at Grav-i-Flo. This authoritative tumbling source can furnish you, from its years of experience, the correct answer to any tumbling problem.

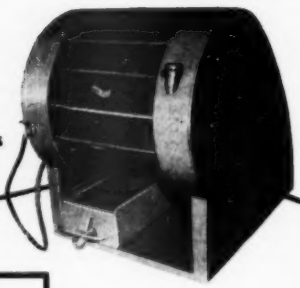
Larger capacity machines take 31% to 80% more work-load in same floor space. Improved cutting materials shorten cutting cycle by 15% to 25%. Grav-i-Flo installations substantially reduce capital investment, floor space, and production time!

Model 66″, two compartments

MACHINES

Model 48″, two compartments

Grav-i-Flo 66″, 48″ and 36″ machines have cam locked doors with manually released safety stops; available with unlined or rubber lined cylinders, constant or variable speed drive, J.I.C. controls, and timers from 5 minute to 20 hour cycles. Equipped with electric wiring and water piping installed ready for plant hook up.



Model 36″, two compartments

Model 24″, two compartments

Designed For Small Lot Production and Laboratory Processing.

ACCESSORIES

Two deck parts-and-chips separator and chip grader

Occupies less floor space. Separates parts quickly without impingements. Grades 3 sizes of chips simultaneously.

Other Grav-i-Flo accessories include tubular yoke hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

Chips and compounds

Grav-i-Flo natural and synthetic deburring and finishing chips and highly developed compounds consistently outperform every type of tumbling process offered on the market.

Investigate!

Grav-i-Flo superiority in equipment and supplies has been proved to hundreds of users in many different industries. Let us show you, too, at no obligation. Our representative will visit your plant, or send samples direct to us. Engineering Service available to all users.

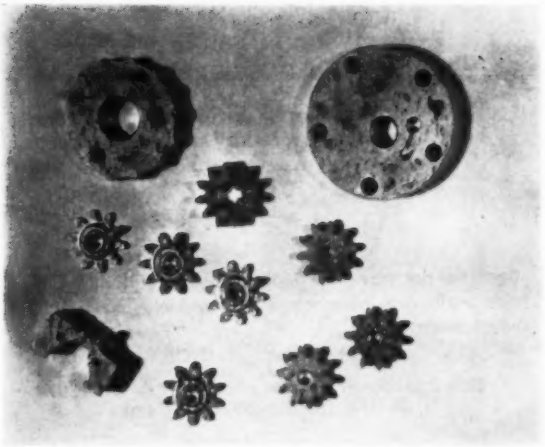
SEND FOR CATALOG showing complete line of Grav-i-Flo equipment, accessories and supplies.

THE GRAV-I-FLO CORPORATION

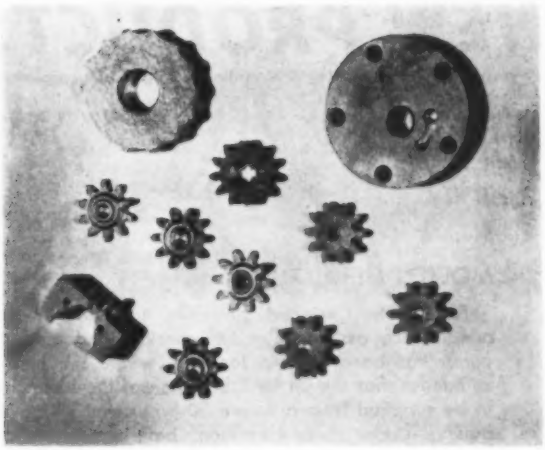
Dept. PM-5 400 Norwood Avenue

STURGIS, MICHIGAN

For additional information Circle No. 29 on the Reader Service Card



WITHOUT IMPREGNATION TREATMENT prior to cadmium plating, these adding machine sinterings showed pitting after 10 days exposure to atmosphere. Exudation of plating salts caused plate failure. Parts were boiled in water, then in oil at 230 F, and finally immerced in cold oil prior to plating.



IMPREGNATION PRIOR TO PLATING of the same adding machine pieces produced excellent plating adhesion. These parts are shown above after five months exposure to atmosphere. The impregnation had rendered the sinterings suitable for plating and has eliminated several production steps.

How a business machine builder prepares SINTERED PINIONS FOR PLATING

HOW practical is the impregnation process recently described in PMM* for sealing sinterings before electroplating? Is it workable on a production basis? These questions have been raised by readers of PMM who have an interest in sealing of sinterings in large quantities.

To find an answer, a major business machine builder who has had considerable experience with this problem was consulted. The Burroughs Adding Machine Company of Detroit was asked about the effectiveness of this impregnating method used on small sintered gears and machine parts for their adding machines, calculators, etc.

They had had previous experience with the impregnation of magnesium instrument housings on a Bendix Aviation subcontract, and impregnation of small bronze "masses" prior to gold plating. They had used the Metaseal process. Because this impregnation method had prevented the bleeding of salts through pores of the "mass", it was adopted for all such work.

Later, when the problem of cadmium plating sintered iron pinions and machine parts arose, Burroughs considered using the same impregnation system. Attempts to plate unimpregnated sinterings had been unsuccessful: the plate was destroyed and the pieces heavily corroded after ten days exposure to atmosphere.

After the Metaseal system of impregnation was introduced, the parts were exposed to five months accelerated atmospheric testing without any sign of break in the plate or corrosion of the basis metal. Comparative test results are presented in photographs above.

The impregnation is carried out now after cyanide hardening of the sintered iron pieces. Impregnation is done outside the Burroughs plant at a reported cost of less than a half cent apiece. Quantities range into the hundreds of thousands, which is evidence of the usefulness of this impregnating method for large quantities of parts.

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*Impregnation as a method of preparing SINTERINGS for plating, by Wilson N. Pratt, PMM Jan. 53, p 47.

NEW PRODUCTS

For additional information on these products circle key number on reader service card bound in this issue.

MOLTEN METAL PUMP

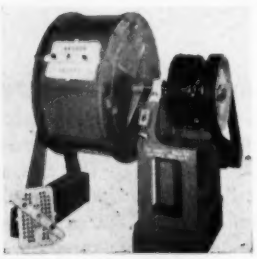
FEATURES: Designed primarily to pump molten metals such as aluminum, magnesium and zinc this pump has been used in locations where the heat is so intense that the oil for lubrication of the motor had to be supplied from a source 20 feet away to prevent boiling. Under these conditions both the motor and the pump stood up without any indicated trouble.

SPECIFICATIONS: Drive is a rotary vane, 3 H.P. air motor with the pumping unit completely immersed in liquid metal. On 99% aluminum the pump discharged 8400 lbs. of molten metal at a temperature of from 1360 to 1400F. Actual pumping time less than four minutes, though the pump was immersed in molten metal for over six hours. In molten zinc, with 90 psi air the pump capacity is 180 tons per hour. Discharge is through a 2 in. pipe riser. Neither the impeller, pump shaft, bearing, or discharge pipe showed any effects from the molten aluminum.

Gast Mfg. Co.

For additional information Circle No. 196 on the Reader Service Card

BARREL FINISHING UNIT



FEATURES: Specifically designed to handle burnishing, de-burring and cutting-down operations this new barrel finishing equipment features precision speed control, interchangeable parts, color dynamics and low operating costs. Because of improved design and a more efficient drive mechanism the barrel can be operated with a comparatively small motor. The primary drive is through "V" belts from a motor mounted on the barrel pedestal.

SPECIFICATIONS: The new barrels are made in four standard sizes and are available in 10 basic combinations with single, double and triple compartments to fit the user's requirements. Standard barrel I. D. sizes for single barrels equipped with maple linings are 24 x 8, 24 x 16, 30 x 8, and 30 x 16. Barrels used for de-burring or cutting-down operations do not have the maple linings. End plates and side walls are interchangeable and can be replaced when worn.

The Abbott Ball Co.

For additional information Circle No. 197 on the Reader Service Card

DECORATIVE PLATING WITHOUT NICKEL

FEATURES: Two decorative plating processes are reported to have the brilliance of copper-nickel-chrome but without using nickel. Protection of steel against red rust is reported as high as 200 hrs. in standard salt spray test when plated and sealed by this process.

Probrite CR-723 is manufactured by Promat Div., Poor & Co.

For additional information Circle No. 198 on the Reader Service Card

SEMIAUTOMATIC CENTRIFUGAL CASTING MACHINE

FEATURES: Vertical 4-spindle turntable-type semi-automatic centrifugal casting machine is adapted for making steel castings in sand or permanent molds.

SPECIFICATIONS: Machine automatically indexes 90° and stops; as it approaches the pouring station it comes up to spinning speed; when metal is poured, a bushbutton initiates indexing the next 90°. The poured mold continues to spin until the metal has solidified and approaches casting removal station, where it is braked to a stop.

Manufactured by Centrifugal Casting Machine Co.

For additional information Circle No. 199 on the Reader Service Card

HAND HONE SHARPENS SINGLE-TIP CARBIDES

SPECIAL FEATURES: Hand hone developed specially for on-machine sharpening of single-point tungsten carbide tools. Claims up to 30% longer "between-grinds" tool life if hand hone is applied at first sign of tool dullness.

SPECIFICATIONS: Made from silicon carbide by XL vitrified bonding process. Operator applies a few light strokes over tool edge, taking care to hold hone flat against surface so as not to round cutting edge or change relief angle.

XL Hand Hone by Chicago Wheel & Mfg. Co.

For additional information Circle No. 200 on the Reader Service Card

continued on page 62

when you THINK of FASTENERS think of CENTRAL...

CENTRAL MAKES EVERY TYPE FOR ALL DIE-CASTING ASSEMBLIES!

TYPE "1" THREAD CUTTING

Better for metal where a thread cutting action supercedes thread forming. Type "1" Central Thread Cutting Screws drive with minimum torque to form a perfectly mated thread and a tight fit. Interchangeable with standard machine screws.

TYPE "23" THREAD CUTTING

Note the wide thread cutting slot that works better in softer metals such as aluminum and zinc, or in harder metals where the wide slot affords better cutting advantages.

TYPE "25" THREAD CUTTING

Here the exclusive wide flute cutting slot combines with a specially spaced thread for low driving torque, high resistance to stripping and extra-free cutting action. Ideally suited to soft metals and plastics. Write for full details.

DRIVE SCREW TYPE "U"

TYPE "A" TAPPING SCREWS

Pointed and augur-like, the Central Type "A" Tapping screw pulls and forms thinner (.015" to .050") sheets of metal into a matching threaded section from punched, drilled, or nested holes. Available with slotted, Phillips, clutch or hexagon heads.

TYPE "B" TAPPING SCREWS

Die-pointed and augur-like for thicker metal (.050" to .200"), Central Type "B" Tapping Screws pass through a hole in one piece, form their own threads to lock both parts securely. For porous castings, non-brittle plastics, fibre and asbestos materials.

TYPE "C" TAPPING SCREWS

Recommended for general use in metals from .030" to .100" thickness. Standard pitch thread interchangeable with standard machine screws. Ideal for chip-free assemblies. Second assemblies can be made on projected end of the screw.

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For additional information Circle No. 28 on the Reader Service Card

ALUMINUM OXIDE COMPO FOR FINISHING DIE CASTINGS

FEATURES: New aluminum oxide compositions for coloring zinc or aluminum base die castings are reported to give the desired lustre or color faster than previously possible with compositions of same fineness. Compositions may also be used in finishing steel or stainless steel.

Hanson-Van Winkle Munning Co.
For additional information Circle No. 201 on the Reader Service Card

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BOX DRAW FURNACE

FEATURES: For applications requiring no controlled atmosphere a new box type draw furnace is available from Westinghouse. Batch work that can be handled on trays is accomodated by the furnace. Heat losses have been reduced to a minimum through the use of a "plug in" type of furnace door. The wide overlap of the door further decreases heat losses.

SPECIFICATIONS: This furnace is available in six sizes ranging from 15 x 24 x 12 to 42 x 72 x 30. The smaller sizes operate on 240 volts and the larger ones on 480 volts.

Westinghouse Electric Corp.
For additional information Circle No. 202 on the Reader Service Card

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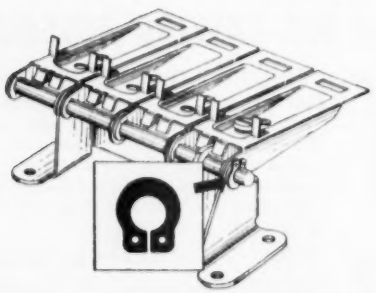
LOCKING COLLAR FOR SMALL SHAFTS



FEATURES: Low cost fastener provides a positive shoulder, secure against thrust & vibration; can be assembled or disassembled in either direction on a straight, ungrooved shaft with Truarc pliers.

SPECIFICATIONS: Basic Truarc design principle of complete circularity around the periphery of the shaft, and the ring's unusually large radial width combine to exert considerable frictional hold against axial displacement. Can be used to take up end-play.

Waldes Kohinoor, Inc.
For sample rings for shaft diameters ⅛" to ⅜, and for additional information, Circle No. 203 on the Reader Service Card

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WIDE RANGE GAS BURNER

FEATURES: Specifically designed to allow a wide temperature range this new gas burner can be used to control furnaces over a range of from 400 to 1800F. This high degree of flexibility makes it possible, when desirable, to use the same furnace for all sorts of annealing, hardening and tempering operations. Developed to allow easy installation the burner block is an integral part of the burner. The tile is firmly cemented into a cast iron jacket and then held in place with hooks to prevent any leakage between tile and casting. This construction minimizes over-heating the furnace shell.

SPECIFICATIONS: The burners may be operated with air pressures ranging from 0.1 to 16 oz. at the burner. Built in five sizes the capacities range from 28,000 to 2,620,000 Btu per hour depending upon burner size and air pressure. All burners are built to accomodate a standard North American pilot system, and a conduction type flame safety device.

North American Mfg. Co.
For additional information Circle No. 204 on the Reader Service Card

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DIAMOND LAPPING KIT

FEATURES: Designed for a wide variety of diamond micro-finishing and precision lapping, this kit is a welcome addition to any tool room utilizing diamond compounds in finishing and lapping.

SPECIFICATIONS: The kit contains nine Spectrum grits ranging in size from 120 to 14,500, all in accordance with U. S. Bureau of Standards specifications. In addition are included a bottle of diamond lapping oil, an atomizer oil applicator, an assortment of Spectrum micro laps, orange-wood sticks and felt mounted points. The kit is supplied in a walnut finished wood case with a lock.

Penn Scientific Products Co.
For additional information Circle No. 205 on the Reader Service Card

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HEAVY DUTY METAL PULVERIZER

FEATURES: Designed to reduce metal scrap to chips at a rate of from 35 to 50 tons per hour, a new heavy duty pulverizer handles a wide variety of feed stock. Metal turnings, cast crankcases, pistons, pots and pans are all reduced to chips. Advantageous space to weight ratio makes metal chips more economical for the scrap metal dealer to ship and in addition the chips command a higher market price because of the lower handling costs when charging into remelt furnaces.

SPECIFICATIONS: The new crusher uses the rolling ring principle. The manganese steel shredder rings are reversible for longer life, are mounted so that massive pieces of tramp metal will not damage the crusher, and the feed is so designed that wear across the ring surface is uniform.

The American Pulverizer Co.
For additional information Circle No. 206 on the Reader Service Card

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METAL FASTENER

FEATURES: A drive pin type of fastener for attaching name plates, covers, brackets, etc. to heavier structural parts. The pin requires only light hammer blows to set it in a drilled hole of the same nominal diameter as the pin shank.

SPECIFICATIONS: A pin type fastener with three parallel grooves, equally spaced and impressed on the shank of the stud. The pins are available in round, flat and countersunk head styles in lengths from ⅛ to ½ and shank diameters from 0.067 to 0.250.

The Driv-Lok Pin Co.
For additional information Circle No. 207 on the Reader Service Card

BECAUSE Hydro-Finish employs fine mesh abrasives suspended in water, it does a precision cleaning job without danger of excessive metal removal. Tolerances are held to .0001"! Result: more years of service from your dies!

What's more, Hydro-Finish saves you time and labor. Operated by one man, it removes scale and discoloration in *minutes* instead of hours! Cleaned surfaces are virtually free of directional grinding lines, eliminating or reducing further finishing operations.

Get the facts on how Hydro-Finish can save you money! Write today for Bulletin 1400A. Address: PANGBORN CORPORATION, 3500 Pangborn Blvd., Hagerstown, Md.

Get **PANGBORNITE.** Best abrasive for all liquid blasting needs. Available in many mesh sizes.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment.

Pangborn

BLAST CLEANS CHEAPER
with the right equipment for every job

Circle No. 73 on the Reader Service Card

NEW FILM AVAILABLE ON CONTINUOUS CASTING

A new, full-color, 35mm. sound-slide film, describing the patented ASARCO process for continuous casting of bronze rod, tubes and shapes, has been completed by American Smelting and Refining Co. It is available to interested groups without obligation

The film is in two parts of about 15 minutes each. The first section describes the history of the process, its engineering details, and its results. The second emphasizes typical applications for which this unique material is used in industrial plants.

Technical societies, professional clubs, schools, engineering staffs, or other groups interested in this instructive film can call or write the Continuous-Cast Products Department, American Smelting and Refining Co., Barber, N. J. Where possible a lecturer will be provided; the film is available free.

Circle No. 83 on the Reader Service Card

FREE!

61 PAGES OF FACTS FIGURES PHOTOS ON BARREL FINISHING

Get the complete story! Learn about latest developments in equipment, compounds, abrasives. Amazing results now possible on almost all types of parts from large castings to small intricate parts.

Write Today For 3 FREE Booklets

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ALBEA **Supersheen**

AMERICA'S LARGEST MFGR. OF ADVANCED BARREL FINISHING EQUIPMENT, MATERIALS & COMPOUNDS

ALBERT LEA, MINNESOTA

Are You Getting the Best Castings Made?

Central offers complete modern facilities, strategically located which assures you of getting prompt dependable service on the best castings made.

CENTRAL SERVICES PROVIDE:

- **Complete engineering and design service**
- **Wide range of quality aluminum and zinc alloys**
- **Die and Tool making**
- **Machining and finishing facilities**

Make use of our complete service and mail in your defense production requirements for prompt quotation.

CENTRAL

DIE CASTING and MFG. CO.

2935 West 47th Street • Chicago 32, Illinois

For additional information Circle No. 67 on the Reader Service Card

REFERENCE MATERIAL

Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.

1. DRY FILM LUBRICANTS of molybdenum disulfide and graphite dispersed in various carriers are described in a bulletin available from Acheson Colloids.

2. INDUCTION MELTING of die casting alloys is discussed in a new Ajax Engineering Corp. bulletin.

7. NEW FEATURES and improvements in die casting machines are detailed in the Cast-Master catalog.

8. MINIATURE OR LARGE die castings, whichever you need, are described in the General Facilities Bulletin offered by the Dollin Corp.

9. DIE CASTING BY HOOVER is an informative booklet about the facilities of Hoover's die casting plant.

11. THE PRACTICAL APPLICATIONS and advantages of investment casting are described in a booklet from International Nickel Co.

12. DIE CASTING machines by Kux are described in an illustrated catalog.

13. TYPICAL INSTALLATIONS and applications of Lester-Phoenix die casting machines are described in the "Lester-Press", a house organ.

14. MELTING FURNACES for die casting plants. Information and "case-history" data available from Lindberg Engineering Co.

21. HOW DIE CASTINGS ARE MADE, a booklet that "tells all" is available from Pressure Castings, Inc.

22. MELTING, HOLDING & SMELTING furnaces are described in the new Stroman catalog.

25. WHICH ALUMINUM ALLOY TO USE, consult the Alloy Selector distributed by U. S. Reduction.

26. BUFFING CALCULATOR, to answer most buffing questions for the shop man put out by the American Buff Co.

27. ABRASIVE GRAINS & POWDERS, an informative publication of the Carborundum Co.

28. THREAD CUTTING SCREWS and bolts are described in the Central Screw catalog.

29. TUMBLE FINISHING with Grav-I-Flow equipment is the subject of the new catalog. All types of accessaries and supplies are also listed.

32. PLASTER MOLD CASTINGS by Atlantic Casting & Engineering form the subject matter of a book "Quality Precision Castings for Industry".

35. SPECIAL METAL POWDERS, with complete physical and chemical properties, are available from Metal Hydrides.

37. DIMENSIONING DIE CASTINGS, a reference manual, is offered by Newton-New Haven.

38. CONVENIENT DATA FILE giving pertinent information about die lubricants for die casting dies is available from G. W. Smith.

41. IRIDITE FINISHING PROCESS for protecting metal surfaces is described in literature from Allied Research Products.

43. BACKSTAND BELT POLISHING, is the subject of a free booklet from Armour & Co.

44. SELF TAPPING INSERT BUSHINGS and Groov-Pin locking pins are listed and described in a folder from Groov-Pin Corp.

45. BARREL FINISHING with 3M products, a booklet from Minnesota Mining & Mfg. Co.

47. CERTIFIED ZINC and precision aluminum die castings form the subject of a booklet from Advance Tool and Die Casting Co.

49. COST REDUCTION thru investment castings, a guide to the design and use of investment castings in industry. Casting Engineers, Inc. will furnish it.

52. SMALLNESS UNLIMITED in zinc die castings; described by Gries Reproducer Corp. in their brochure.

53. ZINC ALLOYS for die casting are described in the literature available from Henning Bros. & Smith.

56. ALLOYS FOR DIE CASTING are the subject of information pieces published by R. Lavin & Sons.

57. DESIGNING ALUMINUM & MAGNESIUM die castings is discussed in literature put out by Litemetal Dicast.

REFERENCE MATERIAL — cont.

59. THE HOW'S & WHY'S OF DIE CASTING are told in literature from Paramount Die Casting.

62. DRYING PROBLEMS? Write for information on the drying of metal from New Holland Machine.

63. HOW TO CLEAN DIE CASTINGS, described in Oakite Products new booklet "Good news about electrocleaning zinc die castings".

64. ENGINEERING DATA BOOK on small die casting machines, from ABC Die Casting Machine Co.

66. ALLOYS TO YOUR SPECIFICATIONS, a description of the unique service offered by Cannon-Muskegon Co.

73. HYDROFINISHING TO SAVE MONEY, a bulletin of facts on liquid abrasive blast by the Pangborn Co.

76. ENGINEERING BULLETIN from Eaton Mfg. Co. describes their self-tapping fasteners.

77. MACHINE DE-BURRING, how it can save money, is told in illustrated literature from Nobur Mfg. Co.

78. TOOL ROOM & PRODUCTION grinder-miller is described in a catalog from Precise Products.

81. CARBIDE ROTARY BURRS and files are listed in the general catalog of Severance Tool Industries, Inc.

83. BARREL FINISHING-61 pages of facts and figures about the Almco Supersheen methods.

84. DIE CASTING MACHINES built by Lake Erie Engineering are described in new bulletin.

AMERICAN CHEMICAL PAINT COMPANY
AMBLER PENNA.

Technical Service Data Sheet
Subject: ***GRANODIZING**** FOR LONG PAINT LIFE ON STEEL

"GRANODINE" FORMS A DURABLE PAINT BOND

Granodizing forms a crystalline, zinc phosphate coating on steel. This ACP paint-bonding process chemically changes the surface of steel into an inert non-metallic coating made up of thousands of microscopic zinc phosphate crystals.

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Granodizing can be accomplished by:

1 Dipping the work in tanks;
2 Spraying the parts in a power washer; or
3 Brushing, spraying, or flow-coating the work with portable hand equipment.

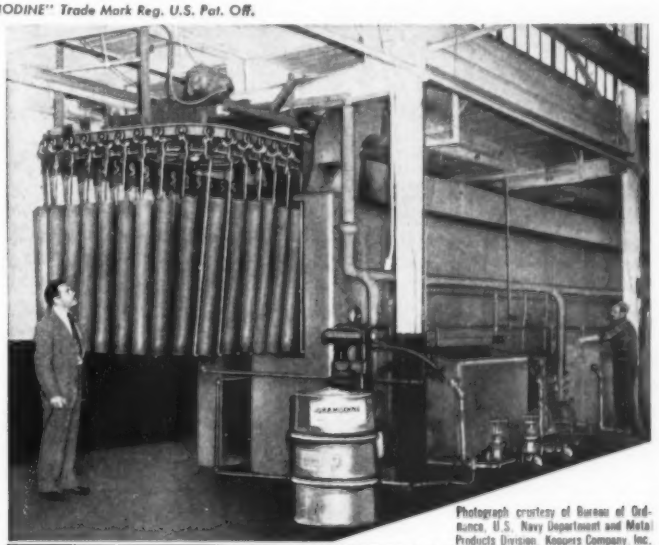
Choice of process is usually decided by such factors as the size, nature, and volume of production.

"GRANODINE" STANDARD PRACTICE ON BOTH CIVILIAN AND MILITARY PRODUCTS

Automobile bodies and sheet metal parts, refrigerators, washing machines, cabinets, etc.; projectiles, rockets, bombs, tanks, trucks, jeeps, containers for small arms, cartridge tanks, 5-gallon gasoline containers, vehicular sheet metal, steel drums and, in general, products constructed of cold-rolled steel in large and continuous production are typical of the many products whose paint finish is protected by "Granodine".

In military production, "Granodine" is used to obtain a zinc phosphate finish meeting Grade I of JAN-C-490 and equivalent requirements of other specifications.

*"GRANODINE" Trade Mark Reg. U.S. Pat. Off.



Photograph courtesy of Bureau of Ordnance, U.S. Navy Department and Metal Products Division, Keasbey Company, Inc.

Typical power spray washing machine for the automatic application of a protective phosphate coating to metal parts in preparation for painting. These 5" rocket motor tubes, as well as products made of cold rolled sheet steel, are effectively phosphate coated in such equipment.

CHEMICALS ACP PROCESSES

For additional information Circle No. 42 on the Reader Service Card

Make the HAMMER Test!

See why Super-Honite Chips last twice as long!

REGULAR HONITE FOR TOUGHEST NATURAL CHIP—No other natural barrel finishing abrasive—not even granite—retains its edge as long as regular Honite. Use it for close tolerance work or where a minimum of metal removal is required.

Hit an ordinary synthetic chip with a hammer. See how it crumbles, pulverized by the force of the blow. Now, hit a piece of Super-Honite the same way. See how *it* fractures in cleanly-divided, large segments. Takes a *harder* blow! The hammer test shows how Super-Honite—the world's toughest abrasive chip—stands up better than any other barrel finishing abrasive. Eliminates lodging. And Super-Honite is the *only* chip engineered for both grinding and burnishing . . . the *only* chip you can rely upon for double duty, double life performance.

Make the hammer test and see the difference! See why Super-Honite never crumbles.

Write today for your free copy of "3M Barrel Finishing" . . . filled with helpful information on increased efficiency, lower costs. Address Minnesota Mining & Mfg. Co., Dept PM-53, St. Paul 6, Minn.

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For additional information Circle No. 45 on the Reader Service Card

WEATHER-RESISTANCE OF ALUMINUM REPORTED

Through a 20 year corrosion study on aluminum — the longest and most intensive analysis of its kind ever made — aluminum has achieved a new record in withstanding atmospheric weathering and corrosion.

This was established by two papers presented recently by Aluminum Company of America scientists before the Ninth Annual Conference of the National Association of Corrosion Engineers.

The first paper, given by C. J. Walton, D. O. Sprowls, and J. A. Nock, Jr., covered the results of a quarter-century of world-wide research. Service installations of aluminum that had been exposed to the atmosphere as long as 52 years were covered in the research findings; controlled test specimens have been exposed at weathering stations up 20 years.

The report proved conclusively that aluminum alloys are highly resistant to corrosion after such long periods of exposure. Aiming particularly toward architectural and structural uses of aluminum, the report brought out aluminum's "self-stopping" characteristic. This is its tendency to reduce the rate of weathering to a minimum after an initial exposure period.

W. W. Binger, R. H. Wagner, and R. H. Brown discussed the resistance of aluminum alloys to chemically contaminated atmospheres in the second paper. Proven is aluminum's high resistance to corrosion by a wide variety of chemicals. Greater use of aluminum in the chemical industry and by concerns in highly industrialized areas is thereby forecast.

Definite savings in reduced corrosion loss and lower maintenance costs were reported in the paper for many industries where aluminum had been used for such applications as roofs, windows, ducts, ladders, and the like.

USEFUL LITERATURE

To receive copies of the publications described here circle key number on reader service card bound in this issue.

PROCESSES

Intricate Investment Castings 144
In an 8 page booklet the Jelrus Precision Casting Corp. describes its facilities and illustrates some of the complex investment castings that are being made.

Miniature Die Castings 145
A small parts catalog and free samples are available from the Dollin Corp. The catalog describes the Dollin automatic die casting machines for making small zinc parts and illustrates some of the many die castings they have made.

Design Data Book on Investment Casting 146
The Mercast (frozen mercury pattern) process for making precise investment castings is described in a data book just issued by the Alloy Precision Casting Co. The book gives design information, tolerance and finish data, and other pertinent information for the designer.

Process Design and Control Service 147
The designing, engineering and building of special equipment, coordinated process controls and panelboards are described in a new 4-page bulletin from Equipment & Controls Engineers, Inc.

MATERIALS & EQUIPMENT

Small Flexible Vacuum Furnace 150
The National Research Corp. vacuum furnace is fully described in a 4-page brochure. Features of the furnace, uses, and available extra equipment are described in some detail.

Automatic Selective Location Hardening 151
Hardening the I. D. of holes in dies has been a hit-or-miss proposition until the development of the I. D. Hole Quencher according to the manufacturer, the Palmer Mfg. Co. A four page pamphlet describes Palmer's I. D. hole quencher.

Die Casting Lubricant and Parting Agent 152
Colloidal graphite suspended in water for die casting die lubrication is the subject of a booklet from Acheson Colloids Co. describing two "dag" products useful in the die casting field.

Metal Powder Cores 153
A recently issued data sheet from Magnetic Powders Inc. lists the company's powders and gives the magnetic characteristics of each.

Salt Baths for Heat Treating 154
A well documented and illustrated booklet is available from American Cyanamid Co. Typical heat treating problems and illustrations of parts being successfully heat treated are given together with the properties of the various salts.

Metal Melting Furnaces 155
A new bulletin on the complete line of Lindberg-Fisher gas and oil fired aluminum melting furnaces contains photographs of the different types of furnaces, describes their uses and gives specs. Available from the Lindberg Engineering Co.

Melting Furnaces for Aluminum, Iron and Brass 156
In a series of five new bulletins recently issued, the Eclipse Fuel Engineering Co. describe their oil and gas fired reverberatory furnaces and furnace equipment such as burners, mixers, blowers.

Standard and Special Chucks 157
Catalog No. 753, published by the Westcott Chuck Co. has been announced. This catalog describes and illustrates all of the chucks made by this company and details the special facilities available for non-run-of-mine jobs.

Air Operated Controllers & Electronic Pyrometers 158
Air operated, Free-Vane controllers are described in a new 32-page bulletin published by the Bristol Co. Instruments for control of pressure, temperature, liquid level, flow, etc. are described. Also just published by the same company is a bulletin describing electronic pyrometers. Complete specifications for all instruments are given.

Pneumatic Temperature Control 159
A 4-page bulletin on the pneumatic temperature control unit manufactured by AiResearch Mfg. Co. is currently available. The bulletin describes a light weight, low cost, rapid response pneumatic temperature control that operates automatically around preselected values.

Indicating & Controlling Pyrometers 160
A new 12-page bulletin on indicating and controlling pyrometers has just been published by General Electric Co. describing design features, applications operation, functional principles, construction, and specs.

New Line of Hydraulic Cylinders 161
In a new 10-page catalog, the S-P Mfg. Corp. announces a line of space saving hydraulic cylinders. The catalog gives physical data on 11 different models as well as useful hydraulic data.

Vises for Fast Set-up 162
A new, illustrated, 4-page folder on utility vises has been issued by the Brown Engineering Co. The folder describes uses for the vise in setting up work on drill-presses, millers, grinders, shapers and other machines.

Vane Type Air & Vacuum Pumps 163
In catalog No. 752, Leiman Bros., Inc. describes the construction and operational features of a 4-wing and a 2-wing pump. The pumps are designed for a vacuum of 29.9 in. and pressures up to 25 psi.

continued next page

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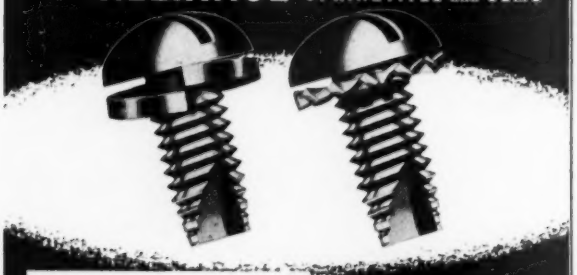
• REDUCE ASSEMBLY TIME
• BALANCE INVENTORIES
WITH RELIANCE "THREAD CUTTING" SPRINGTITES and SEMS



Pre-assembled Springtites and Sems Especially Designed For Use with Die-Castings

Available with or without washers

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USEFUL LITERATURE
continued from page 67

Copper Oxide in Foundry Practice 164
The advantages derived from the use of copper oxide in foundry practice are described in literature available from The Glidden Co.

Manual on Thread Milling Cutters 165
A complete, up-to-date manual on thread milling and thread milling cutters is available from Detroit Tap & Tool Co. The manual gives technical information on thread milling, speeds and feeds, maintenance, inspection and tolerances, milling cutter types plus a catalog of standard blanks carried in stock.

Catalog of Countersinks, Counterbores & Core Drills 166
A quick reference catalog listing supplies complete engineering and buying data on counterbores countersinks and core drills. A wide range of sizes is covered and also a section on inserted-blade cutters. Available from the Modern Corp.

Product Directory of Beryllium Copper 167
A 16-page booklet listing a complete selection of materials and forms available in Beryllium copper and beryllium alloys has just been published by the Beryllium Corp.

Machine de-burring with NOBUR pays BIG production dividends!

NOBUR Tools *turn a slow bench operation into fast and efficient machine work!* Remove burrs on multi-walled parts with a smooth, clean cutting action that won't mar highly finished surfaces. Eliminate rejects from slow, costly hand work with files, scrapers and abrasives.

Nobur Tools are used on any lathe, drill press, portable drill or flexible shaft. Operation of the double-edge cutting blade is easy and safe . . . no skilled help is required, and the spindle *never needs to be stopped* for either de-burring or chamfering.

Nobur Tools cut freely on either hard or soft metals, are simple in construction and are made in sizes to cover a full range of hole diameters. *NEW "DS" SERIES extends range of NOBUR applications to holes as small as 1/8" diameter. WRITE FOR FULL DETAILS TODAY!

Parts like these quickly de-burred with NO/BUR TOOLS

NOBUR MANUFACTURING COMPANY
719 N. VICTORY BLVD., BURBANK, CALIF.

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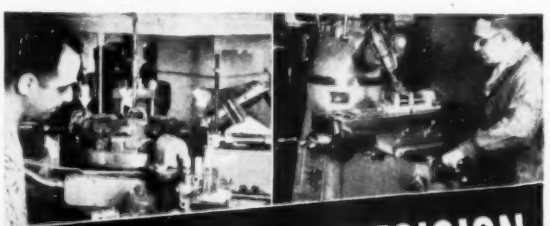


LOWEST COST PRECISION FOR TOOL ROOM AND PRODUCTION

ONE PORTABLE MULTI-PURPOSE PRECISE GRINDER-MILLER WITH MACHINE TOOL MOUNT DOES THE WORK OF A SINGLE-PURPOSE MACHINE COSTING 100 TIMES AS MUCH!

Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¼ HP, speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing; rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

Write FOR NEW CATALOG

PRECISE PRODUCTS CORP., 1342 Clark St., Racine, Wis.

Precise GRINDER-MILLERS

For additional information Circle No. 78 on the Reader Service Card

Plastic Investment Patterns 168
Complete data and specifications of plastic injection machines manufactured by the Van Dorn Iron Works Co. are covered in a booklet. Machines are used for making investment casting patterns.

Socket Cap Screw Data Book 169
Available from the Bristol Co., a new data book listing the socket cap screws made by that company together with special features and uses. Illustrated.

Engineering Data Book 170
The heavy duty oil hydraulic pumps and motors made by Waterbury Tool Div. of Vickers, Inc. gives technical information and drawings. The book covers all available types and sizes with design data and suggested uses. Typical case histories are included.

FINISHING

Handbook of Vapor Degreasing 175
A technical handbook on vapor degreasing as well as a brochure on degreasing equipment is available from the Phillips Mfg. Co.

Zinc Phosphate Coating for Steel 176
A specal service report from Oakite Products, Inc. give data on recommended methods of application, suggested solution concentrations, operating temperatures, etc. as well as typical use information on Oakite CrysCoat HC.

Joining Aluminum to Steel 177
The Alumnibond data book published by Arthur Tickle Engineering Works fully describes method of obtaining a high strength bond with good mechanical and metallurgical properties between aluminum and ferrous metals.

High Temperature Lubricants 180
A series of new lubricants for operating temperatures 300F to above 500F are announced by the E. F. Houghton Co. In the lower temperature range a highly refined, high flash point mineral oil is used, while in the higher temperature ranges colloidal graphite or molybdenum disulfide in a volatile carrier are used. The new oils are fully described in a 4-page bulletin.

Lower Contact Wheel Costs 181
Through the use of a carefully balanced universal contact wheel hub, over 144 different tires of varying width and durometer hardness can be accomodated. On a new hub described in literature available from the Carborundum Co.

Precision Barrel Finishing Machine 182
A 200 lb. capacity deburring barrel specifically designed for small parts or small lots of larger parts has been developed by the Rampe Manufacturing Co. The hexagonal shaped barrel is described in a leaflet prepared by the manufacturer.

Surface Treatment for Aluminum, Zinc, & Cadmium 183
Two technical publications of the Parker Rust Proof Co. describe their new Bonderites for aluminum, zinc or cadmium. These phosphate coatings are used either as corrosion inhibitors by themselves or a paint bases.

Anodic Conditioner For Die Castings 184
A new anodic conditioner for die cast zinc known as Oakite Composition No. 95, is reported in a booklet to give brighter plates and fewer rejects.

Yes, that statement was made by one of the manufacturers who cooperated in the field-testing of Oakite Composition No. 95.

He has found many advantages in this new anodic conditioner. Some of these advantages may be of value to you:

Brighter plating—Anodic conditioning with Oakite Composition No. 95 removes all films that might impair the brightness of the electroplate . . . no interfering residues . . . no under-surface shadows . . .

No anodic blackening—Castings do not lose their buffed-on brightness.

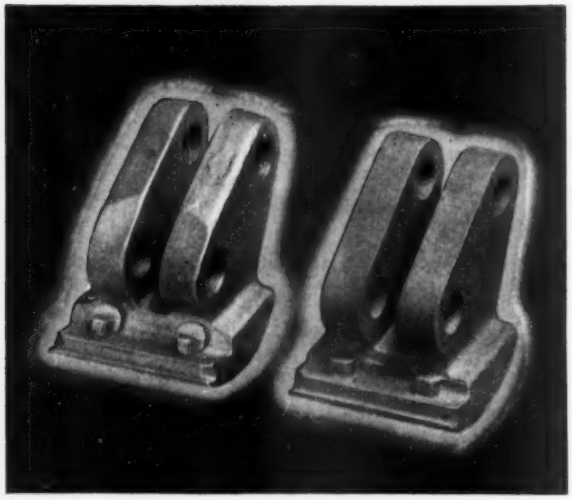
Fewer rejects—Oakite Composition No. 95 eliminates the major causes of peeling and blistering . . . consistent success in test-baking for 60 minutes at 300° F.

FREE For a copy of "*Good news about electrocleaning zinc-base die castings*"—describing the use of Oakite Composition No. 95—write to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE
Technical Service Representatives in Principal Cities of U. S. & Canada

For additional information Circle No. 63 on the Reader Service Card

Which one is investment cast?



They may look alike but the part at left was machined from a tool steel forging and cost 36% more to produce than the tool steel investment casting at right.

Tolerances
as close as ±.002" were maintained on this casting and were equivalent to the machined tolerances.

Tensile strength tests
showed no loss in strength from replacing the forging with tool steel casting.

Investment casting
proves economical by eliminating machining, handling of raw materials, service failures and spoilage.

Investment casting
results in substantial economies in producing metal parts of all kinds, especially those whose intricate design or material used make it impossible or costly to machine.

ENGINEERED PRECISION CASTINGS

For a guide to important savings, send for our informative brochure "Cost Reduction thru Investment Castings"

CASTING ENGINEERS INC.

2323 BOSWORTH AVENUE, CHICAGO 14, ILL.

For additional information Circle No. 49 on the Reader Service Card

LARGEST ATTENDANCE RECORDED AT ANNUAL M. P. A. MEETING

The ninth, and most successful, meeting and exposition of the Metal Powder Association was held on April 20-22 at Cleveland, Ohio. Attendance for the business and technical sessions, and the exhibits broke all previous records with more than 750 registering.

Officers elected by the M. P. A. for 1953-54 are: Thomas R. Moore, assistant to vice president, General Dyestuff Corp., New York, was elected president, succeeding Ernest H. Klein, manager, Metal Division, The New Jersey Zinc Sales Co., New York, new chairman of the board. Robert L. Ziegfeld was re-elected acting secretary-treasurer.

William E. Cairnes, president, Radio Cores, Inc., Oak Lawn, Ill., was re-elected chairman of the Electronic Core Division of M.P.A; Thomas L. Robinson, president, Powdercraft Corp., Spartanburg, S. C., chairman of the Fabricators Division; Paul E. Weingart, American Metals Co., New York, chairman of the Powder Producers Division. All three are vice presidents of the Association.

As directors of the Association the following were elected for the next three years: Harrison Stackpole, secretary, Stackpole Carbon Co., St. Marys, Pa., and B. T. du Pont, sales manager, Plastic Metals Division, National Radiator Co., Johnstown, Pa. Fred Lux, president of the Lux Clock Co., Waterbury, Conn., was elected director for two years, George L. Bachner, president, Powdered Metal Products Corp. of America, Chicago, Ill., was elected director for a one-year term. George Roberts, chief metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa., and E. H. Klein, both continue as directors.

MPA OFFICERS

A group of officers elected by the MPA include: L to R, back row: Dr. G. Roberts, T. R. Moore, E. H. Klein, W. E. Cairnes; Front row: R. L. Ziegfield, acting secretary-treasurer; G. L. Bachner, P. E. Weingart, B. T. du Pont. Not present in the photo are F. Lux, H. Stackpole, and T. L. Robinson.

THE PLACE OF SHELL MOLDING
continued from page 31

parison of shell mold with sand and precision casting processes.

This quick comparison reveals:

- Shell mold castings can be used in place of sand castings where a desired quality improvement justifies an increased casting cost. Often, the increased casting cost can be more than wiped out by reduction of finishing costs.
- Shell mold castings can compete with investment castings only when the accuracy, design, and finish requirements are within the capabilities of shell practice.
- Higher tool-up cost for the shell method favors the other processes on extremely short runs.

Shell molding should rarely be considered as a replacement for die casting except when

continued next page

PEERLESS
STANDARDIZED PINIONS and RACKS
FOR
DIE CASTING MOLDS
PERMANENT MOLDS
PLASTIC MOLDS

Standard sizes of Peerless "Flame Hardened" Ejector Racks and Pinions are available for prompt shipment. Special sizes may be produced to your specifications.

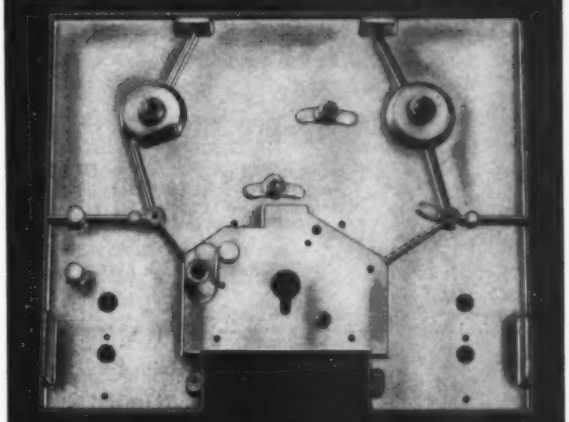
We welcome your inquiries.

Peerless Gear & Machine Co.
320 N. WESTWOOD AVENUE
P.O. Box 317, Station "C"
TOLEDO 7, OHIO
Established 1921

For additional information Circle No. 74 on the Reader Service Card

Light Metals for Portability
Tape Recorder Mechanism Plate Die Cast in Aluminum or Magnesium

WILCOX-GAY TAPE RECORDIO



When minimizing weight is required, aluminum and magnesium alloys meet the need. However, these new lightweight metals offer other most important advantages. When they are die cast they effect other great savings. For example: The die cast mechanism plate for the Wilcox-Gay Portable Tape Recordio shown, features on its underside (illustrated above) bosses for mounting electronic and mechanical parts with bearings, recesses and holes cast in the plate in a single operation. You can see at a glance how much labor-time the manufacturer has saved by having this part die cast — also, machining, finishing and assembling has been virtually eliminated. Savings such as these aid considerably in competitive selling.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information.
Quick action on inquiries.

LITEMETAL DICAST, Inc.
A DIVISION OF HAYES INDUSTRIES
1925 WILDWOOD AVE · JACKSON, MICHIGAN
PLANT AND EXECUTIVE OFFICES

For additional information Circle No. 57 on the Reader Service Card

36½" die casting in one piece with Cast Teeth!

produced by

PARAMOUNT

- Material: #3 Zinc Alloy
- Length: 36½"
- Weight: 2.2 lbs.
- Gear Rack: 279 teeth, 24 pitch
- Calibrations: By 1/16ths

A little out of the ordinary? Yes. But this casting demonstrates what can be done when engineering know-how, die-making skill and die casting techniques are teamed. The result: substantial savings for the customer in material and machining costs!

Your design problems might be of a different nature, but still require the same specialized knowledge and skills. A complete die casting service is available to you at PARAMOUNT to help you solve these problems. We welcome your inquiries. Descriptive literature available on request.

ALUMINUM & ZINC DIE CASTINGS

PARAMOUNT

DIE CASTING CO.

St. Joseph, Michigan

For additional information Circle No. 59 on the Reader Service Card

there is a desire to go to a material which cannot be die cast. No comparison is made here with the plaster mold method.

The shell process is capable of handling all of the normally castable alloys. As with all other methods, the soundness of castings is dependent upon proper gating and foundry know-how.

Case history of an aircraft component

Aircraft exhaust manifold supports used by Ryan Aeronautical Company have been produced by sand casting, investment casting from mercury patterns, and shell molding. Figures 3-5 show parts produced by each of these methods. The conical portion of this 18-8 stainless part is welded to the sheet metal duct work. The cone is hollow to save weight. The bore in the cylindrical boss is held to ± .001 and the length of this boss also to ± .001. These dimensions must be machined when any of these casting methods are employed.

TABLE 1

COMPARISON OF CHARACTERISTICS OF THREE CASTING METHODS

	Shell	Sand	Investment
Surface finish	Medium	Poorest	Best
Accuracy	Medium	Poorest	Best
Intricacy	Medium	Medium	Best
Tool costs	Highest	Lowest	Medium
Casting costs	Medium	Lowest	Highest

The part illustrated as a sand casting in Figure 3 and as an investment casting in Figure 4 has a finished weight of 5¼ ounces. The sand casting, weight 16-½ ounces, had to be machined all over except on the exterior of the cylindrical boss. This boss was cast solid and required drilling and reaming of the bore as well as facing the ends. The outside

of the cone was completely machined as well as the inside of the cone which was cast solid. Thus. 68 percent of the casting weight was turned out of the difficult-to-machine austenitic stainless steel.

Economy was effected by switching manufacture to the mercury pattern casting process. This reduced the as cast weight to 6-¼ ounces. The only finishing operations were facing the boss ends and boring and finishing the hole cast through the boss.

When a general design change was made, manufacture was switched to shell mold casting shown in Figure 5. Those same areas, which on the investment cast part were used in the as cast condition, ,are as cast on the shell mold part. Equal machining is required for both methods. Overall economy favors shell mold for this piece.

Summary

Shell mold castings are low cost precision type castings. Judicious use of them will make this method one of the high volume production processes. Because of the relative newness of the process, potential users of these parts are urged to have thorough engineering consultation with castings producers before design details are completely established.

CABLE SPLICER
continued from page 40

and tapping two or three holes in the back of each one. These holes are for mounting and in some cases, not even these are needed since an adequate mounting means can be incorporated in the castings.

Corrosion resistance is another important consideration in the choice of metal for this service. Since the transmission of heat to the mold pieces is entirely by contact of the mold with the heater, it is essential that the interface be the best possible metal-to-metal contact. The heated shoes and the mold halves must, therefore, be of a material which will not form a thermally resistant layer due to either oxidation or atmospheric corrosion.

Both sulfur and chlorine are normally present in the rubber being vulcanized. At the operating temperatures, the mold metal must resist chemical attack of these materials as well as attack by other rubber additives. Again, aluminum has been found to be the best material for this service.

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"VITALLIUM" IS REGISTERED TRADE MARK

The editors of PMM have been informed by Austenal Laboratories, Inc., that the word "Vitallium" was used incorrectly in the article, "Some Physical Properties of Investment Cast Alloys," Feb. PMM, p 43. The word is a registered trade mark belonging to Austenal and refers only to dental and surgical alloys and appliances made by that company. It is not synonymous with AMS-5385B and is not properly described as an "industrial alloy".

THREE GIVEN AWARDS

Three members of the Carboloy Department of General Electric Company have received G. E.'s highest award for employee achievement.

Charles A. Coffin awards were made to: Otto K. Hittenberger, general foreman; Ernest A. Hughes, supervisor-electrical maintenance; and Perry D. Weiser, application engineer. A fourth, Francis W. Pierson, methods equipment specialist, received honorable mention.

NEW HOUGHTON PLANT MAKES RUBBER PACKINGS

Construction of a new plant for the manufacture of synthetic rubber packings, and the formation of a subsidiary company for this purpose, has been announced by E. F. Houghton & Co., Philadelphia.

This new plant, already in production, is being operated as Houghton Vix-Syn Co., 140 Washington Street, South, Hopkins, Minnesota.

ALUMINUM PRODUCTION SETS 12-MONTH RECORD

U. S. production of primary aluminum during 1952 hit an all-time peak, Donald M. White, secretary of The Aluminum Association, has disclosed. "The yearly production reached a total of 1,874,642,692 pounds, 34 million pounds above the previous peak established in 1943," he said. The new record was 12 per cent greater than 1951 figures when 1,673,758,854 pounds were produced. "Production of 470,719,-231 pounds during the last quarter contributed greatly to the new level" Mr. White said.

CHAMPAGNE FOR BREAKFAST!

At an inhumanly early hour of the morning (8:30) on Wednesday April 22, the Metals Disintegrating Co. of Elizabeth N. J. was host to a group of "old timers" in powder metallurgy. The occasion, to commiserate with Bill Toeplitz of Bound Brook Oil-Less Bearing Co. and Paul Weingart of American Metal Co. who, on that day and on the following Saturday (in the order named) had to admit to the official passing of another year. Floated on a lake of champagne the breakfast was a "howling" success.

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PACIFIC NORTHWEST GETS INVESTMENT CASTING PLANT

Forming of Precision Castparts Corp., and full scale commercial operation of the company's plant at 8705 S. E. 13th Ave., Portland 2, Ore., has been announced by Joseph B. Cox, president of the new firm.

The plant is reported to be the first of its kind to be established in the Pacific Northwest, and gives to the area complete investment casting facilities for both ferrous and non-ferrous metals.

The company's present plant occupies 8000 square feet of space in a new building occupied in March, 1952. Equipment includes wax injection machines, burn out furnaces, steel melting furnaces, tool and die equipment, grinding and finishing equipment. The plant operates its own metallurgical laboratory. Castings from alloy steel, stainless steel, high and low carbon steel, bronze, brass, aluminum and other hard metals are produced.

Other officers of the corporation are Edward H. Cooly, general manager; William Simpson, superintendent of plant operations.

SINTERED PINIONS
continued from page 46

Due to the tool wear, it was not possible to hold center dimensions close enough on the machined extrusions. Therefore, it was more practical to extend the center hole by providing a hub.

The hub is not practical on the tiny sintering, but neither is it necessary. Reference to the drawing will show that center hole tolerance specified — and held by the fabricator is .126 + .001 — .000.

This center tolerance is so close that it has been possible to introduce polished shafting with a resultant precision fit between shaft and pinion. Polished shaft was not practical previously due to variations in hole size.

Inspection of tooth shape, concentricity and hole diameter on production have indicated that the sinterings are less subject to variation than machined extrusions. In fact, rate of rejects is negligible.

A similar close tolerance has to be specified on thickness of pinions. As Figure 3 shows, the pinions fit between the counter wheels and must not wedge nor be too loose. For this reason, dimension of .114 + .001 — .000 has been specified. This is somewhat more difficult for the fabricator to meet because the dimension is formed by the upper and lower punches in the pressing

continued next page

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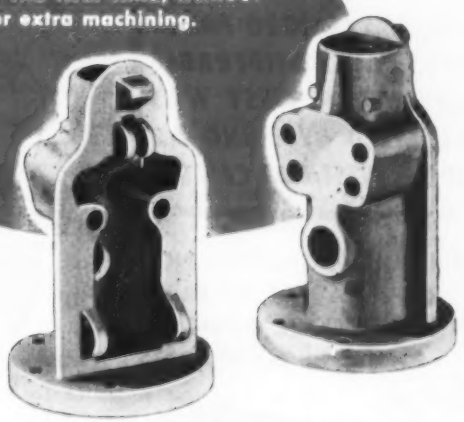

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operation. Nevertheless, once the tools are made and working to proper tolerance, this dimension is being met on a production basis.

The one other design change, besides the elimination of the hub, is the introduction of a small radius (.015) in the corners. This was not necessary when the teeth were milled, but is desirable in powder metallurgy. This radius — or lack of it — has no functional effect and thus was permitted as a design change.

There is a growing potential for sintered pinions and gears in precision instrument manufacture. Aside from the iron sinterings, Production Instrument Company has also been using sintered bronze gears, particularly where a gear is combined with another form such as a ratchet. Here, the self-lubrication of the oil impregnated metal is useful.

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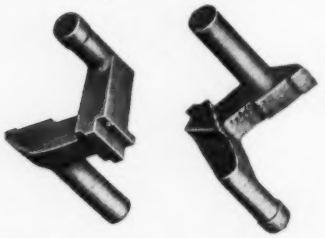

Castings pass 100% X-ray inspection. Material: Alloy Steel AISI 8620

THE ILLUSTRATION SHOWS A PAIR OF LEVERS USED IN A HIGH-SPEED GUN BREECH MECHANISM

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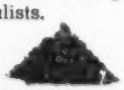

Unwashed Shot

Cannon-Muskegon Shot

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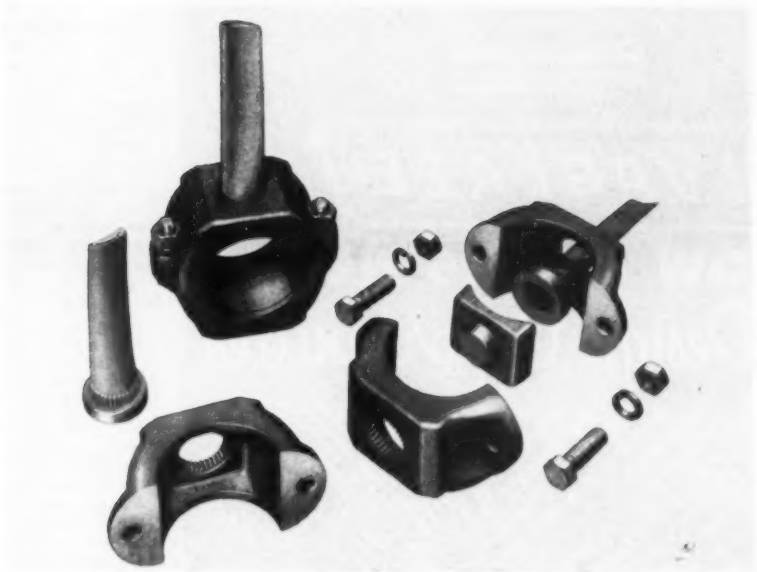
SIMPLIFIED SOLUTIONS

for production problems



A COMPLETE ASSEMBLY—can often be made up of investment castings for the price of machining a single component from rough castings. This is all the more likely to be true when a special alloy is needed. Shown here is just such an assembly, investment cast in 18-8 stainless. It is complete and ready to assemble as cast. Only the bolts, nuts and lock washers are not investment cast.

This unit, investment cast by Howard Foundry Company, is a paper stock agitator and must obviously have good resistance to corrosion, as well as reasonably good strength and wearing qualities.

Two vanes, used in each assembly, are cast with gear teeth shouldered against the base flange. These mate with teeth cast inside the vane clamps, permitting them to be positioned at the desired pitch during assembly. Accuracy of dimension is not too critical, but uniformity for proper balance to prevent cavitation at tip speed of 84 feet per second, is a consideraton.

Assemblies of this type are not produced in large quantities, but even so, substantial savings can be made by eliminating all machining and other secondary operations.

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DIE CASTING SALESMAN: Covering Indiana desires to represent a titanium casting account, a plastic molding account and a powdered metal account on straight commission basis. Write Box 5253, Precision Metal Molding magazine.

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FOR SALE: One B-T-600 aluminum cold chamber die casting machine with Reverb Stroman gas-fired furnace, 400-500 pound pot cap. Completely set up with all controls. Used only one month.

One No. 4 Walsh Hi-speed Press 1" stroke, automatic,

One No. 2 Walsh Hi-speed Press 2" stroke,, automatic, both with Rowe Easy Load Feed. Write Box 5453, Precision Metal Molding magazine.

FOR SALE: 2 — Model BT-500 B & T Engineered zinc die casting machines, 2 years old, in good condition, on a where is, as is basis. Can't be duplicated for twice the price. Excellent reason for selling. Write Box 5553, Precision Metal Molding magazine.

FOR SALE: One air compressor Ingersoll-Rand. 500 P. S. I. cross compound imperial type XOB complete with 75 H.P. In operation now. Write Box 5653,, Precision Metal Molding magazine.

FOR SALE: Detroit Electric rocking furnace type GM serial 1038, capacity 35 lbs., now in operation American Precision Casting Corp., 7711 Lyndon St., Detroit 21, Mich.; Phone Diamond 12171.

High Temperature, Corrosion Research Projects Planned by Alloy Casting Institute

Ranging in scope from a fundamental study of corrosion to the development of new high strgenth and high temperature alloys, a broad pattern of research programs for the next five years has been set up at recent meetings by the Alloy Casting Institute technical committees.

Looking toward the future needs of high alloy castings users, certain projects have been designed to increase fundamental knowledge of alloy structures and corrosion behavior; in addition, investigations have been planned with more immediate objectives. Results of these studies are expected to provide materials useful to designers in meeting expanded needs for higher operating temperatures and stronger materials of construction in modern industrial processes.

Continuing scarcity of alloying materials, particularly nickel, makes it imperative to have suitable alternate alloys, and several projects are being devoted to accumulation of data on alloy grades now infrequently used. Moreover, primary metal scarcities have forced greater reliance on the use of scrap by foundries, with attendant problems of alloy contamination.

The ACI will investigate maximum quantities of "tramp" elements permissible in high alloy castings from the viewpoints of foundry characteristics, high temperature strength and corrosion resistance, to ensure continued availability of high quality products.

Meeting higher operating temperatures

The increasingly greater emphasis being placed on higher operating temperatures for increased efficiency of chemical and metallurgical processes has created a problem of developing materials of construction that can withstand these new conditions. Available materials have not provided the required properties. Three projects have been designed by the ACI technical committees to develop improved alloys.

In a continuing study of corrosion under pressure and high temperature at the Ohio State University, under the supervision of Dr. M. G. Fontana, a recognized authority in the corrosion field, commonly used alloys of the 18-8 variety (CF-8 and CF-8M) and high nickel grades are being investigated in a variety of corrodents.

Modifications of these alloys will be studied to develop improved corrosion resistance and methods for inhibiting corrosive attack. Preliminary results suggest the possibility of utilizing tiny amounts of inhibiting agents in chemical fluids being processed. On this subject, a paper, "Corrosion by Aqueous Solutions at Elevated Temperatures and Pressures," by F. H. Beck and M. G. Fontana, Ohio State University, was presented at the recent annual meeting of the National Association of Corrosion Engineers in Chicago.

Use of low carbon wrought stainless steels, of chemical compositions similar to the cast corrosion resistant grades, in service at temperatures in the 1000 to 1600F range, has resulted in a demand for castings in such applications. To provide mechanical property design data, the 12 Cr (CA-15), 8M), 25 Cr-12 Ni (CH-20) and 25 Cr-20 Ni (CK-20) grades will be studied at temperatures of 1000, 1300 and 1600 F. The investigation, which will be conducted at the Battelle Memorial Institute, will include 100 and 1000 hours stress-rupture tests, creep tests, and short-time hot tensile tests.

One of the areas where such demand has arisen is in the manufacture of jet engines. Although available data indicate that the cast alloys of the higher carbon heat resistant types probably have better mechanical properties in the 1000-1600F temperature range than the low carbon corrosion resistant grades, other considerations may make it desirable to modify the materials. Thus, this research may ultimately point toward the development of special alloys specifically tailored for jet engine use.

Another important research in the Battelle program is directed toward the development of alloys suitable for service above the range 2000-

continued next page

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2100F. The objectives are to provide either mechanical and corrosion resistant properties better than obtainable with present alloys, or to achieve equivalent properties with alloys of lower strategic alloy content.

Alloy conservation

Shortages which exist and promise to continue for some time in the supply of alloying elements such as nickel, cobalt and columbium, have prompted several projects devoted to alloy conservation. A study authorized at Battelle will determine the high temperature strength properties of alloys not too widely used at present, but which appear to be useful to design engineers as possible alternates for higher nickel alloys.

These grades have regular ACI specification designations — HC (28 Cr), HD (28 Cr, 5 Ni), HE (28 Cr, 10 Ni), HI (28 Cr, 15 Ni), HL (30 Cr, 20 Ni), and HN (20 Cr, 25 Ni) — but they are not used as extensively as some of the better known alloys because their heat resistant properties have never been completely studied. The proposed investigation will last about five years, and should enable these grades to take their places among the more widely used types.

Another study authorized at Battelle involves an investigation of comparative resistance of three heat resistant grades — HH (25 Cr, 12 Ni), HK (25 Cr, 20 Ni), and HT (15 Cr, 35 Ni) — to 1000-hour exposure to carburizing atmospheres at 1700-1800F. The HT grade is normally used in carburizing service, but previous research and some field experience indicates the possibility of using the HH and HK types as well.

An important contribution to alloy conservation will be the study of the effect of "tramp" elements on corrosion resistance, heat resistance and foundry characteristics of cast high alloys. With limited am-

ounts of primary metals available, it is necessary for alloy producers to utilize the maximum amount of purchased scrap. Unfortunately, the general scrap problem is now acute; not only is there a shortage, but scrap is improperly segregated and unknown elements are thus introduced. These "contaminants" include copper, tungsten, lead, tin, antimony, zinc, aluminum, arsenic, cadmium and others. This investigation will attempt to determine the maximum amount of such elements that can be tolerated in castings intended for specific applications.

First being studied are the widely used low carbon 18-8 (CF-8) and the 18-8 molybdenum (CF-8M) corrosion resistant types. The investigation of the effect of unwanted elements on mechanical properties at elevated temperatures will be confined at the outset to the HT grade, and will include thermal fatigue and hot tensile tests at 1600F. This investigation will include determination of the influence of "tramp" elements on hot cracking of metal during the casting process. Thus, from the results of the investigation users can be ensured of contined production of castings which meet the exacting specifications of high temperature strength and corrosion resistant service.

High strength corrosion resistant alloys

The insistent demand for cast alloys having the corrosion resistance of the 18-8 types, but with much higher strength than now available in these grades, has been recognized. Objectives of the project are to develop, if possible, materials with two basic types of mechanical properties: (1) A cast material having minimum yield strength of 100,000 psi and 10 percent minimum elongation; (2) a hardenable cast material providing a minimum of 350 Brinell hardness, with

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5 percent minimum elongation — this alloy would be particularly useful for anti-galling or anti-seizing applications. The goals of combined high strength and corrosion resistance are considered realistic.

Fundamental research

The problem of understanding corrosion is recognized as complex; for instance, it is impossible to transfer results obtained in a specific corrosion test with a specific alloyed material to another set of conditions or materials. To understand why various corrodents act differently with different alloys — producing generalized corrosion with some, intergranular corrosion with others, and pitting or localized corrosion in others — a fundamental, long-range study of corrosion has been authorized at Ohio State University under Dr. Fontana.

After an initial literature survey, experimental work will be performed first on the cast high alloy grade CF-8, the most popular type in the corrosion resistant division of the ACI alloy series. When basic information is obtained, a rational approach will be possible to the development of new materials, and modification of present alloy for specific corrosion service.

A second basic research program to be initiated will be a study of the relationship, if any, between the magnetic and corrosion-resistant properties of the CF-8 grade. Preliminary evidence based on nitric acid tests shows no difference in corrosion resistance between the magnetic and non-magnetic varieties of the CF-8 grade. However, the study will attempt to show whether there is any difference in other media.

The investigation will also include a determination of the chemical ranges necessary to ensure wholly austenitic alloys of low magnetic permeability, since the CF-8 alloys are sometimes used where the non-magnetic properties are essential. The effect of each constituent element on magnetic permeability will be thoroughly investigated, as well as the "mass effect" of section size on permeability.

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NEW FILM ON BRASS

With the release of "Brass Means Business," Titan Metal Manufacturing Co., of Bellefonte, Pa., has brought the story of brass manufacturing to the screen. Produced by Unfilms, Inc., this 16-mm sound and color film pictures the steps in the making of alloys and the manufacture of brass and bronze products.

Inquiries should be made to: Film Department, Titan Metal Manufacturing Co., Bellefonte, Pa.

INDUSTRY NEWS

KEWANEE-ROSS EXPANDS INTO CANADA

Richard N. Mathews has been elected vice president of Kewanee-Ross of Canada Limited, and placed in charge of the firm's new general offices at 57 Bloor Street West, Toronto, W. Bradford Russell, president has announced.

The recently formed company was established to provide engineering and sales service to Canadian industry on all types of shell and tube heat exchangers, coolers, surface and barometric condensers, steam jet ejectors, and high pressure steam boilers.

The new company is a division of American Radiator & Standard Sanitary Corporation and is affiliated with Kewanee-Ross Corporation of Kewanee, Ill. and Buffalo, N. Y.

Mr. Mathews was serving as Kewanee-Ross Corporation's West Coast Manager with headquarters in San Francisco prior to being elected vice president of the new firm. A graduate of Oklahoma A & M University, he joined American-Standard in 1930 as a sales engineer. In 1933 he was transferred to Ross Heater & Mfg. Company, Inc, a predecessor of Kewanee-Ross, and was engaged in sales work with that firm until his recent election.

APEX SMELTING OPENS WEST COAST PLANT

Apex Smelting Co., one of the nation's major smelters of aluminum, magnesium and zinc alloys, celebrates its 30th anniversary year with the opening of a new million dollar smelting plant in the Los Angeles industrial area near Long Beach, Calif.

This plant brings to the West Coast both a new source of quality alloys and a facility which will consume locally the scrap aluminum and magnesium which is generated in large quantities by Southern California factories and which formerly had to be shipped to the midwest for consumption.

The plant, located at 2211 East Carson Street, on a 20-acre site, consists of a 54,000 sq. ft. production building and laboratory and an additional administration and office building. All units are designed to permit future expansion at the same location.

Plant material handling equipment is of latest design and its laboratory facilities which include a Quantometer, assures rigid metallurgical production control.

J. M. DAVIS RETIRES AS UNION DIE CASTING HEAD

J. M. Davis, one of the die casting industries "old timers", has announced his resignation from active leadership of the West Coast die casting firm which he has long headed.

J. M. Davis

His resignation as president and general manager of Union Die Casting Company, Los Angeles, was recently announced.

"J. M.," as he is generally known throughout the industry, will continue to serve as special consultant to the Board of Directors.

New officers elected are Walter H. Bodle, president and general manager to succeed Mr. Davis, J. A. Campbell, vice president, and Fred Champion, secretary-treasurer.

His resignation marks the conclusion of 23 years service for Mr. Davis in the management of Union Die Casting Company. In a message addressed to members of the Pacific Coast Group of the American Die Casting Institute of which he has been chairman for six years, "J. M." states that he will devote more time in working with the group in the future.

MAGNESIUM SHOW ATTENDED BY 10,000; WIDE INTEREST SHOWN

To demonstrate to the general public, as well as to industry the remarkable growth that has occured in the uses and applications of magnesium metal and magnesium base alloys; the first industry-wide exhibit was held in Washington, D. C. on March 31-April 2.

Attendance at the show, which was sponsored by the American Magnesium Association, exceeded 10,000.

Exhibits ran the gamut from tiny die castings to monster 2000 lb. sand castings and over 100-ft. extension ladders.

While many of the applications exhibited were for the armed forces, there existed a strong feeling that when present heavy government purchases end and a consumer economy is established, the ingot price of magnesium will be reduced so that many new applications of this light metal will become reality.

As pointed out by several of the company representatives having exhibits, the heavy use of magnesium by the government has most desirable long-range effects. Under the impetus of a defense economy; methods of forming and fabricating, including joining, have been developed that might never have been done otherwise. All of this development work will, in time, be freely available to the industrial consumer of magnesium metal when wider use is made for consumer goods.

One of the bug-bears that has plagued the magnesium industry is the galvanic corrosion that takes place when the metal is in contact with other metals under bad atmospheric conditions. This is largely overcome now through the use of new surface coating methods that have been developed, including both electroplating with either nickel and/or chromium and chromate treatments where decorative appearance is not important or where a good base for paint or laquer is required.

Many cases were pointed-up where magnesium, particularly die cast magnesium was originally used as a substitute material when aluminum was in short supply and has now become standard. Weight advantages, improved machinability and other factors offset the cost differential that formerly prevented the use of magnesium in die cast parts.

Promoters of the show feel that it will become one of the regular industrial shows of the country — annually if new uses and new developments warrant.

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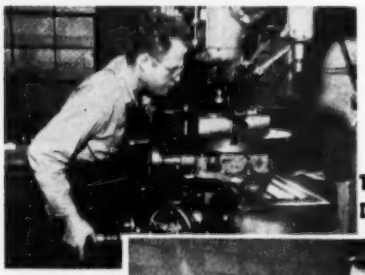

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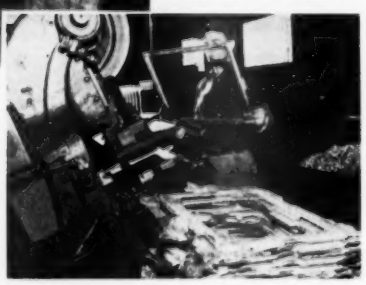

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ALLOY PRECISION NAMES NEW ENGLAND REP.

Appointment of Harry I. Dixon as New England representative of the Alloy Precision Castings Company, Cleveland, Ohio, has been announced by S. J. Sindeband, president.

Mr. Dixon, a graduate of the University of Michigan, is widely known in the metallurgical field to which he has devoted more than 25 years.

Following employment as metallographer and metallurgist for General Motors Research Corp., Crucible Steel, and New Jersey Zinc Co., he served as vice president of the Park Chemical Co. and Sterling Alloys Company.

Mr. Dixon has established an office at 1199 Beacon Street, Brookline 46, Mass.

LIQUID-METALS HANDBOOK, Richard N. Lyon, editor-in-chief; available from Superintendent of Documents, U. S. Government Printing Office, $1.00.

The work done under the atomic energy commission, and its predecessor the Manhattan District Engineer, demonstrated the industrial possibilities of liquid metals for other purposes than preparation for casting into shapes. To utilize these liquid metals intelligently it was necessary to determine many physical properties in the temperature range at which they are liquid.

The first edition of this book was a hasty gathering of all the then available data. This, the second edition, was prepared more leisurely and as a result many of the errors and omissions have been corrected.

For those individuals who utilize liquid metals this handbook will be found to be of great value. The contents include the industrial uses of liquid metals, physical and chemical properties, corrosion by liquid metals, heat transfer and heat transfer systems using liquid metals and the availability of materials.

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There is a theory that a man who specializes in mouse-traps will build better mouse-traps than one who makes merely wood or metal products. This is the narrow view of the self-conscious specialist.

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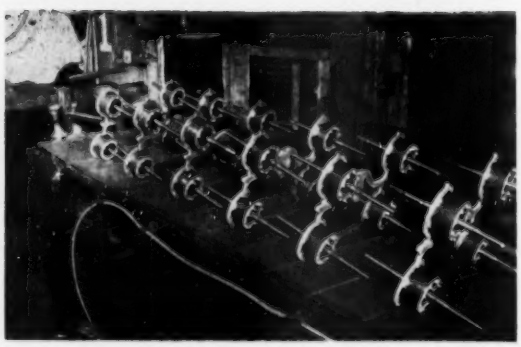
Die Lubricants: Part One
THE SILICONES

By D. M. FRANCISCO,*
and R. S. NAEGELE**

DIE CASTING LUBRICATION

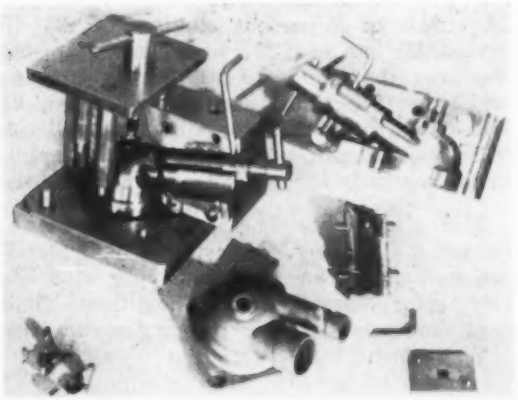
Ejector die of a 500-ton cold chamber machine, just prior to ejection of the 4-cavity casting. The retriever is in position, right. The pins protruding from the casting will be the shafts of the finished rotors.

Ejected, the casting rests on the automatic retriever. Motor rotors of this type are mostly laminated iron with the aluminum acting as a filler.



The retriever, extreme left, automatically deposits the castings on a conveyor. Silicone compound emulsion is used to prevent sticking of castings. Above photos courtesy Westinghouse Electric Corp.

INVESTMENT CASTING LUBRICATION



Typical investment casting setup, showing the wax pattern and many die components. All of these parts are lubricated with a two percent solvent silicone fluid. From three to five patterns are obtained per application. Dies are reported to stay clean for long periods. Photo courtesy Arwood Precision Casting Corp.

THE silicones are a group of semi-inorganic fluids, compounds, resins and rubbers. Among them are several mold lubricants and release agents that are widely used in the rubber, plastics, baking and metal casting industries. Here, as in most of the commercial applications for silicone products, their usefulness is due in large measure to their stability at temperatures far above and below the limits of comparable organic materials. As one might expect of materials chemically related to sand and the mineral silicates, silicones are also relatively inert and highly resistant to oxidation.

In actual practice, this means that silicones will not react chemically with the molded product or the mold itself. Easily applied with brush or spray, their low surface tension allows them to cover large areas evenly and to penetrate rapidly the most intricate cavities. They do not give off smoke, odor or fumes at molding temperatures, and they cannot break down to form a carbonaceous deposit or stain at any temperatures. Effective in surprisingly low concentrations, they minimize build-up, reduce cleaning schedules and prolong die life.

The basic silicone release agents include a compound with the consistency of petroleum jelly[1] and a water-white fluid with the viscosity of a light machine oil.[2] Both are soluble in a wide variety of common solvents for spray application. Most users, however, prefer the oil-in-water emulsions of these materials[3] which can be cut to any desired concentration with water.

Die casting lubricants

Judicious use of these various agents will give a die caster great flexibility in meeting his operating requirements. His application can range anywhere from a heavy coating of

continued next page

* **Manager, Release Material Sales, Dow Corning Corp.**
** **Technical Representative, Dow Corning Corp.**

SHELL MOLDING LUBRICATION

Divided pattern plate makes one complete shell mold for every machine cycle. The pattern is sprayed with silicone compound emulsion before each cycle.

Two shells are bonded together with special pressure sensitive tape. Washed sand cores are set in place before assembling the mold. Photos courtesy The Cooper Alloy Foundry Co.

straight silicone compound every cycle down to a mist of 3 percent emulsion every 15 cycles. He can coat the entire mold or just the area that tends to stick. Dies vary so widely that no hard and fast rules can be laid down, but preliminary testing will determine optimum concentrations and application methods for any set of circumstances.

The Middleville Engineering and Manufacturing Company, for instance, have standardized on silicone lubricants for zinc die casting for years. They use the silicone fluid emulsion, swabbed directly on the die with a small brush. However, they do not cover the entire die surface, but only the especially narrow-drafted or intricate sections of the cavity.

Application ranges from every other shot to once every 10 shots, depending on the complexity of the die. The surface finish of the castings is excellent, and they are ready for plating without any intermediate cleaning.

On the other hand, another zinc die caster cuts this same emulsion with five parts of water and sprays it on the dies at 40 lbs. pressure every six to 20 cycles, again depending on the complexity of the die. One light pass assures complete coverage without excessive chilling. Castings are ready for immediate finishing, and the dies remain clean for a longer period.

Another zinc die casting company combines the two methods. Finding the fluid emulsion to be a most effective agent they dilute it down as low as one part in 42 parts of water, and apply it only to especially intricate die areas.

Much the same thing holds true in aluminum die casting, despite the higher temperatures encountered. Effective concentrations of silicone fluid emulsion vary from 30 percent down to 3 percent, depending upon such variables as the mass and surface area of the casting, the number of inserts, and the depth and draft of the dies.

The Redmond Company, for example, die casts aluminum "squirrel cage" rotors for miniature electric motors. Silicone fluid emulsion is used because of the excellent results obtained.

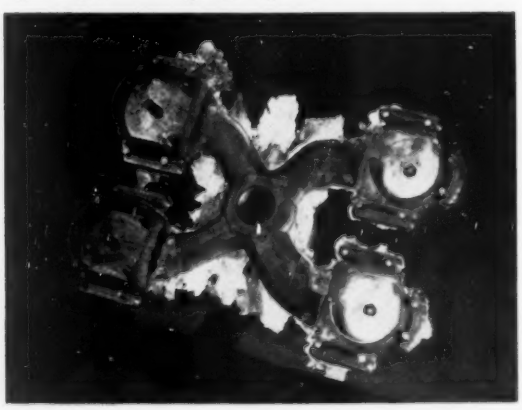
The 4-cavity dies in their cold chamber machines are center gated with a rather long sprue. Although liberally drafted, this sprue still tends to hang up and hold the entire casting in the cover die.

To overcome this tendency, fluid emulsion is cut with 2 parts of water and sprayed, a short burst per shot, directly into the sprue hole. Excess mist covers the rest of the die surface. They have found it possible to run as many as six shots per application, but prefer to insure good release by spraying every cycle. Production ranges as high as 160 shots per hour.

A similar problem on a larger scale confronted the Westinghouse Electric Corporation at their Bellfontaine, Ohio, plant. Dies tooled for four 3-½ inch rotors were mounted in a 500-ton cold chamber machine. An auto-

Silicone emulsion is applied directly to the most complex sections of the ejector die with brush, once every other shot. Photos courtesy Middleville Engineering & Mfg. Co.

Note the high surface finish of this zinc die casting for two tape ruler cases. Trimming is all that is necessary to ready these parts for plating, the company reports.



matic retriever, designed to reach in after the ejected casting and deposit it on a conveyor, was mounted integrally with the machine.

Several months after the installation went on production, however, the rotors began sticking in the cover instead of the ejector half of the die. The problem was caused by the fact that the section cast in the ejector half of the die was almost identical to the section cast in the cover half. There was, consequently, little tendency for the rotor to stick in the ejector half. Castings had to be removed manually, and the retriever could not be used.

The die lubricant which solved this problem was the silicone compound emulsion. Possessing a slightly higher silicone content and a little more "body" than the fluid emulsion, this material forms a somewhat more durable parting film. It is rapidly gaining in popularity for high-temperature, high-pressure work.

Cut with 10 parts of water, the compound emulsion was sprayed only on the cover die every four shots. It was immediately effective, and has continued to be. Sticking has been reduced to a negligible level.

There has been little opportunity to evaluate the advantages gained by breaking in brand-new dies with silicones. Fort Recovery Industries, gave the subject some study recently when they redesigned a triple-cavity die used for bathroom plumbing hex nuts. They had noted that new dies required a great deal of conventional lubricant for the first few castings. So much so, in fact, that surface finish was affected and the castings often had to be scrapped.

When the newly redesigned dies were mounted, therefore, they were washed thoroughly with solvent to remove every trace of organic cutting oil. A heavy coating of silicone compound was rubbed into their surfaces. After the excess was wiped off, the dies were brought up to operating temperature. They were then sprayed quickly with 10 percent solution of the compound emulsion in water. The spray was checked carefully for uniform coverage without excessive chilling.

Casting was begun at once. The very first piece was ejected easily, with a normally high surface finish and no evidence of excess lubrication. Further applications were limited to once every 10 to 15 shots, depending upon the die temperature and condition. Actually, the condition of the die remained almost unchanged. Partly because of its simple contours, it was still as clean and accurate as ever after one million shots.

continued next page

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SILICONE LUBRICANTS — cont.

Fort Recovery found the operating cleanliness of the silicone agents especially noticeable, and free of disagreeable fumes, smoke or odor. The absence of a greasy film on and around the machine was also noted, and the elimination of hazardous solvents.

Shell molding process

Authorities consider shell molded castings to be midway between sand and investment castings in surface finish and in dimensional accuracy. Faster and easier than sand casting, shell molding is rapidly becoming to the high-melting alloys what die casting is to the low. It is a two-step process, however, with the most critical step first. This is the production of a thin, light shell of resin-bonded fine sand which is precisely molded to emulsion, however, even at concentrations as low as 10 percent make it particularly well-suited to the shell process.

Investment casting process

Where shell molding calls for two steps, precision investment casting requires three. Again, the first is the most critical. If the wax or plastic pattern is not defined correctly in every detail, there is no use going further. The pattern is not quite as fragile as a shell mold, but it is even more precise and exact. It must be released effortlessly.

Many investment casters agree that for either wax or plastic work, silicone fluid is easy to apply; produces the most patterns per application; keeps the molds clean longer; and provides excellent surface finish. The concentrations they use, however, range from 100 percent down to 2 percent silicone fluid in a hydrocarbon or chlorinated type solvent. Methyl ethyl ketone is generally preferred. Service life ranges from two to 10 injections per application.

the contours of a pattern plate.

To assure thorough consolidation of the sand-resin mix, surface temperatures of the pattern must be maintained constantly at 400 to 500F. Silicones, as parting agents, will neither react with the shell nor break down after long exposure to these temperatures and form a heavy carbonaceous build-up. As a result, they have been associated with the process since its initial development in this country.

The compound has been referred to as "silicone jelly" in several papers, and was originally applied from a solvent solution. It was to avoid the

Dow Corning emulsion 35, reduced with two parts water, is sprayed directly into the cover die to prevent the aluminum sprue from sticking. Photo courtesy The Redmond Co.

expense and the hazards involved in the use of solvents in this process that the first emulsion of the compound was developed.

Good practice in applying silicone agents is seen at the Cooper Alloy Foundry Co., which has been shell molding stainless steel valves and pipe fittings since August 1950.

Shells are produced on Cooper Alloy's automatic molding machine at a rate of 350 complete molds a day. The pattern is a 2 inch slab of gray iron with mounted aluminum patterns and gatings, and its temperature never drops below 500F.

New or freshly-cleaned patterns are conditioned with straight silicone compound. In production the patterns are sprayed every few cycles with the compound emulsion cut with 10 parts of water. The patterns are cleaned occasionally with a light solvent solution, to prevent traces of carbonized resin from building up in crevices or intricate recesses.

Several shell molders standardized on the fluid emulsion for production use before the compound emulsion was developed. Many are still using it effectively, especially on deep-section molds where the pattern can be dipped rather than sprayed. The greater body and film strength of the compound

continued next page

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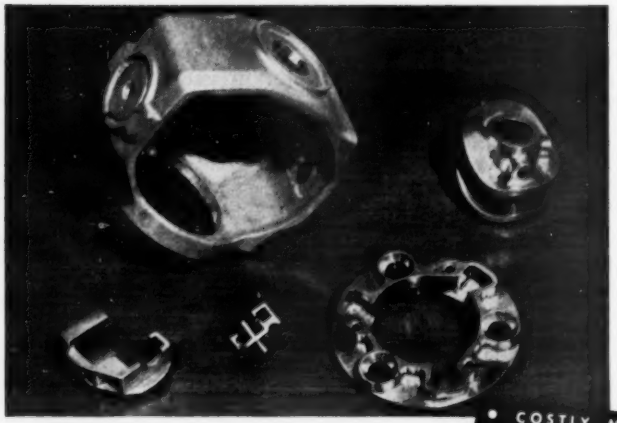

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SILICONE LUBRICANTS — cont.

A caster who is making stator vanes for prototype jet engines has standardized on straight silicone fluid. The fluid is sprayed on the steel mold under high pressure to form as thin a film as possible, and the excess fluid is wiped off with cotton. One application gives release for four to seven injections. After the wax pattern has been removed from the mold it is dipped in acetone to remove every trace of silicone before investing.

Permanent mold casting and ingot pouring

The release properties of the silicones have been found useful in other methods of casting, including some quite highly specialized applications.

In casting a cobalt steel alloy, one company applies a 10 percent concentration of silicone fluid in naptha to a small cast iron strip mold be-

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fore every third pour. Pouring temperatures range from 2700 to 2900F. Practically every possible agent, including chromic oxide, alumina and the silicates has been tried for this application, but to date silicones are the only material which give release without contaminating the alloy.

A leading zinc smelter assures top production from an automatic ingot-casting machine by wiping silicone compound on the mold before each pour with a cloth. His castings also have a more attractive surface finish than they ever before attained.

A brass caster who pours ingots at 2100F sprays the compound emulsion with 20 parts of water, on his cast iron molds every fifth pour. Surface porosity was reduced and the ingots released easily. Bone ash, his former parting agent, had to be applied every third time.

The same concentration has proved successful on a steel mold for sand casting cores. Here the mold was cleaned as thoroughly as possible with solvent and then baked at 450F for four hours to boil off as much of the remaining core oil as possible. It was then heated another four hours, during which time it was sprayed with the silicone compound emulsion every 15 minutes. The silicone treated mold gave very good release, even though it was still brown with core oil residue.

Other fabrication methods

Silicones are undergoing thorough evaluation in connection with several other types of casting. Preliminary reports indicate that they may be helpful in certain varieties of centrifugal, slush, and powdered metal molding. For example, silicones have proven valuable as die lubricants in the powdered metal molding of tungsten and some of the rare metals. They also provide an excellent "primer" coat which prevents plating solutions from penetrating some of the more porous moldings.

The fact that silicones find their greatest usefulness in the newer and more advanced kinds of metal molding and finishing illustrates the modern maxim: "new materials beget new methods." These new engineering materials have helped make some of these advances possible, and they may be the key to making many of them extremely practical. Their ultimate usefulness, rests primarily on the resourcefulness and ingenuity of the design engineer and the production man.

FOOTNOTES

1. Dow Corning 7 Compound
2. Dow Corning Mold Release Fluid.
3. Dow Corning 7 Emulsion, Dow Corning Emulsion 35 and 35B.

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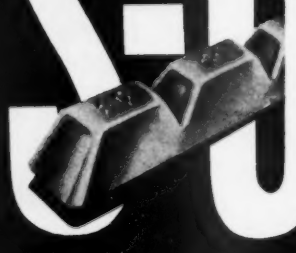

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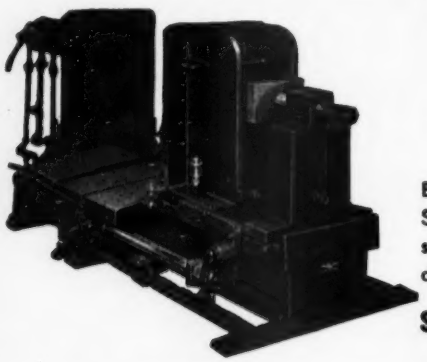

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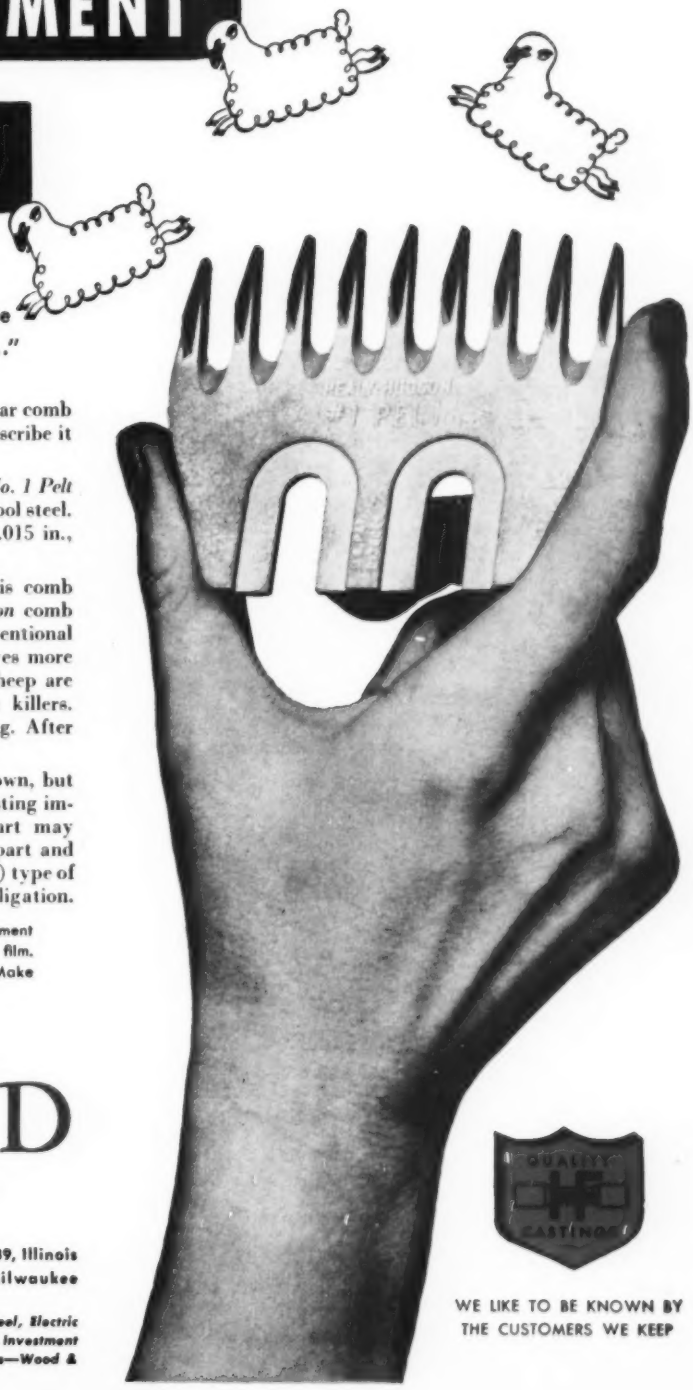

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